THE STANDARD CYCLOPEDIA OF HORTICULTURE

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TORONTO

XL. Formal gardening, with veronica and phlox in the foreground

THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY

L. H. BAILEY

Illustrated with Colored Plates, Four Thousand Engravings in the Text, and Ninety-six Full-page Cuts

IN SIX VOLUMES

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FULL-PAGE PLATES

		Facing page
XL.	Formal gardening, with veronica and phlox in the foreground (in color)	*Frontispiece*
XLI.	A good fern in southern California.—*Alsophila australis*	1217
XLII.	A young Celeste fig tree, as grown in Georgia	1234
XLIII.	Floriculture.—A house of begonias, with a row of ferns	1242
XLIV.	Forcing of grapes.—Muscat of Alexandria	1263
XLV.	Ferns in a public garden, with springtime bloom (in color)	1307
XLVI.	Type of an old-time formal garden.—Washington's garden at Mt. Vernon	1315
XLVII.	Fringed gentian. *Gentiana crinita*	1327
XLVIII.	The garden gladiolus, variety "Peace" (in color)	1343
XLIX.	The Niagara grape (in color)	1380
L.	The grapefruit. About one-third natural size	1391
LI.	A home greenhouse	1410
LII.	Heliotrope, an old-time favorite	1452
LIII.	Good use of spring flowers.—*Mertensia virginica*	1470
LIV.	Herbs and shrubs employed about a pond	1481
LV.	Hollyhock	1497
LVI.	Roman hyacinth.—One of the forms of *Hyacinthus orientalis*	1614
LVII.	A night-blooming cactus.—*Hylocereus tricostatus* in Hawaii. Hedge planted by Sibyl Moseley Bingham between 1831 and 1840	1625
LVIII.	One of the many beautiful garden irises.—Probably one of the hybrid or derivative forms of the germanica group	1657
LIX.	Japanese irises.—*Iris lævigata*	1675
LX.	The black walnut.—*Juglans nigra*	1717

F

FÀBA (*phago*, to eat; yields edible seeds). *Leguminòsæ*. A genus established by Tournefort for certain plants now referred to Vicia. *Faba vulgaris*, Moench, is the horse bean, broad bean or Windsor bean, now accepted as *Vicia Faba*. From other groups in Vicia, it differs mostly in its stiff erect habit and the very large fleshy seeds and pods. The name *Fabaceæ* is sometimes used instead of *Leguminosæ*, and sometimes for the papilionaceous leguminosæ.

FABIÀNA (after Francisco Fabiano, Spanish botanist, Valencia). *Solanàceæ*. Small heath-like shrubs; one is sometimes grown in cool greenhouses and in mild climates for its bloom.

Erect and branching plants, sometimes viscid: lvs. small and crowded: fls. usually many, terminal or opposite the lvs., small; corolla long-tubular, dilated or ventricose above, often contracted at the throat; stamens 5, attached on the corolla-tube; disk fleshy, annular or lobed: caps. oblong, 2-valved.—About 20 species, Bolivia, Brazil to Patagonia.

imbricàta, Ruiz & Pav. Fig. 1471. Height 3–8 ft.: lvs. ovate, scale-like, imbricated: fls. sessile or nearly so, white, with a short reflexed limb, borne profusely. Peru. B.R. 25:59. R.H. 1903, p. 291. G.C. III. 32: suppl. Sept. 27; 52:210. Gn. 60, p. 430; 72, p. 511. G.W. 2, p. 511.—This plant is apparently little grown under glass in this country. It is a rather common shrub in S. Calif., where it blooms at different seasons. In England, it is said to thrive best near the sea. Good bushes produce a wealth of well-lasting bloom in late spring. It prop. without difficulty from potted cuttings in Aug.

L. H. B.

1471. Fabiana imbricata. (×½)

FAGÀRA: *Xanthoxylum*.

FAGÈLIA (after Caspar Fagelius, plant cultivator). Syn. *Bolusàfra*, Kuntze. *Leguminòsæ*. One species, a fast-growing, twining sub-shrub from S. Afr., covered with clammy hairs, and bearing all summer axillary racemes of pea-like fls. which are yellow, the keel tipped violet; standard reflexed; keel obtuse, exceeding the wings; stamens diadelphous: pod about 6-seeded, turgid. Cult. outdoors in S. Calif. and abroad under glass. The plant is allied to Cajanus, but its seeds are strophioled, pod swollen, not flattened, and the 2 upper calyx-lobes nearly distinct. The Fagelia of Schwenke (1774) is Calceolaria.

1472. Fagopyrum esculentum. (×1)

bituminòsa, DC. Sts. several feet long, woody at base: lfts. 3, rhomb-ovate, pale and glandular-dotted beneath, to 1½ in. long: fls. about ½in. long: pod 1½ in. long: plant strong-smelling. B.R. 261 (as Glycine, showing fls. also veined with red).—Blooms in winter in S. Calif.

L. H. B.

FAGOPŸRUM (*beech wheat*, from the likeness of the fruit to a beech-nut). *Polygonàceæ*. Probably only 2 species, of Eu. and N. Asia. Quick-growing annuals, with alternate deltoid or hastate lvs., small whitish fls. in racemes or panicles, 5-parted calyx, 8 stamens, 1-loculed ovary ripening into a floury 3-angled achene.—Both species are grown for the grain, from which flour is made; and in horticulture sometimes used as a catch-crop or green-crop in orchards and elsewhere for the good effect on the land.

esculéntum, Moench (*Polýgonum Fagopỳrum*, Linn.). BUCKWHEAT (which see). Fig. 1472. Lvs. large and broad, long-petioled: fls. white, fragrant, in panicled or corymbose racemes: achene or grain with regular angles.

tatáricum, Gaertn. (*Polýgonum tatáricum*, Linn.). INDIA-WHEAT. DUCKWHEAT. Fig. 1473. More slender: lvs. smaller and hastate or arrow-shaped, shorter-petioled: fls. greenish or yellowish, in small mostly simple racemes from the lf.-axils: achene with wavy or notched angles, smaller than in buckwheat.—Useful in short-season climates and on poorer lands. The Fig. 1473 is made from Linnæus' original specimens of his *Polygonum tataricum*, now deposited in the Linnæan herbarium, London.

L. H. B.

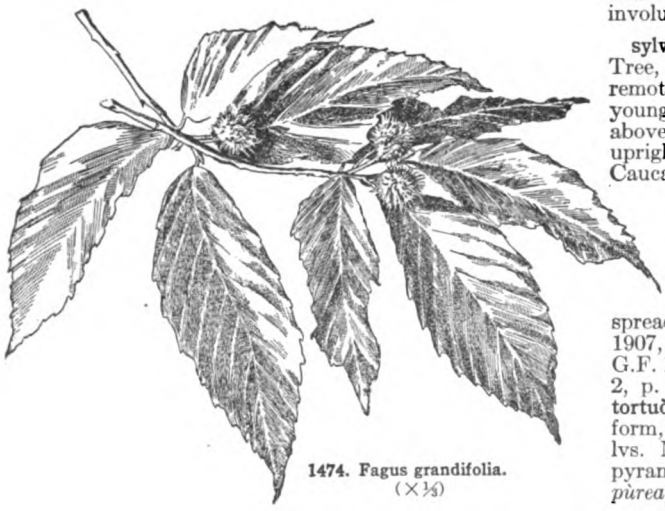
FÀGUS (ancient Latin name). *Fagàceæ*. BEECH. Ornamental trees, chiefly grown for their handsome foliage, good habit and the conspicuous color of the bark; also valuable timber trees. There are marked horticultural forms.

Deciduous: winter-buds conspicuous, elongated, acute: lvs. alternate, distichous, dentate or nearly entire, with caducous small stipules: fls. monœcious,

with the lvs.; staminate in slender-peduncled pendulous heads, appearing at the base of the young shoots; perianth 5–7-lobed; stamens 8–13; pistillate with 3 styles, usually 2 in an axillary peduncled involucre: fr. a brown, ovate, triangled nut, 1 or 2 in a prickly, dehiscent involucre. — Eight species occur in the cooler regions of the northern hemisphere. The species of the southern hemisphere, often included under Fagus (as *F. betuloides* and others), form the genus Nothofagus, which see.

1473. Fagopyrum tataricum.

The beeches are tall deciduous hardy trees, of noble, symmetrical habit, with smooth light gray bark and clean dark green foliage, which is rarely attacked by insects or fungi. They are among the most ornamental and beautiful trees for park planting, and attractive at every season, especially in spring, with the young foliage of a tender delicate green, and the graceful, drooping heads of the staminate flowers. All of the eight species known, save one, are in cultivation and differ comparatively little from each other. The American and the European species are especially much alike, but the first has the bark of a lighter color, the head is broader and more roundish, and the leaves less shining, turning clear yellow in fall, while the latter has a more ovate head and shining foliage, which turns reddish brown in fall and remains on the branches almost through the whole winter. It is sometimes used for tall hedges. In Europe, the beech is a very important forest tree, and the hard and very close-grained wood is largely used in the manufacture of different articles and for fuel; but it is not very durable in the soil. The sweet nuts are edible, and in Europe an oil is pressed from them, used for cooking and other purposes.

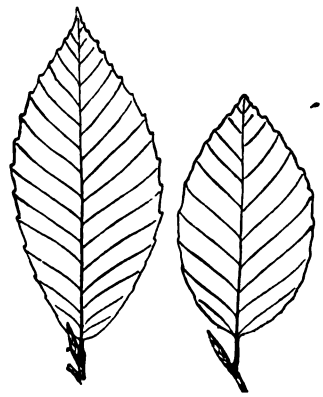


1474. Fagus grandifolia. (×⅓)

The beech prefers dryish situations, and grows best in sandy loam and in limestone soil. Propagated by seeds sown in fall where there is no danger of their being eaten by mice, or dried after gathering and kept mixed with dry sand until spring. The young plants should be transplanted every second or third year; otherwise they make long tap-roots, and cannot always be transplanted successfully. The varieties are grafted on seedling stock, usually in the greenhouse in early spring; grafting in the open usually gives not very satisfactory results.

Both in Europe and the eastern United States the beech forms extensive forests. It is today the common hardwood tree of central Europe, particularly in Denmark and Germany, raised as pure growth or mixture. It requires a loamy, preferably calcareous soil, shuns poor sand and swamp, ascends to 3,500 feet in the Alps; prefers north and east exposures, endures much shade, protects and improves the soil, and produces large amounts of wood to the acre. The wood is heavy (specific gravity 0.65 to 0.75) hard, straight-grained, of close texture, not durable. Beech is not used as building lumber, but is extensively used for ordinary wooden ware, furniture, wheelwright and cooperage stock. (F. Roth.)

grandifòlia, Ehrh. (*F. ferruginea,* Ait. *F. americàna,* Sweet. *F. atropunicea,* Sudw.). AMERICAN BEECH. Figs. 1474, 1475. Tree, to 80 ft., rarely 120 ft.: lvs. ovate-oblong, acuminate, coarsely serrate, silky beneath when young, with 9–14 pairs of veins, dark bluish green above, light yellowish green beneath, 2½–5 in. long: involucre covered with slender, straight or recurved prickles, ¾in. high. E. N. Amer., west to Wis. and Texas. S.S. 9:444. Em. 182. G.F. 8:125. A.G. 12:711. F.E. 20:586. Var. **pubéscens,** Fern. & Rehd. Lvs. soft-pubescent below, sometimes only slightly so. Var. **caroliniàna,** Fern. & Rehd. (*F. ferruginea* var. *caroliniàna,* Loud. *F. rotundifòlia,* Raf.). Lvs. broader, of firmer texture, darker above: involucre rufous-tomentose, with fewer and shorter prickles: nut smaller, not exceeding the involucre. From N. J. and S. Ill. to Fla. and Texas.



1475. Fagus grandifolia (left), and F. sylvatica. (×⅓)

sylvática, Linn. EUROPEAN BEECH. Fig. 1475. Tree, to 80 ft., or rarely 100 ft.: lvs. ovate or elliptic, remotely denticulate, silky beneath and ciliate when young, with 5–9 pairs of veins, dark green and glossy above, pale beneath, 2–4 in. long: involucre with mostly upright prickles, about 1 in. high. Cent. and S. Eu. to Caucasus. M.D.G. 1902:579–582. H.W. 2:20, pp. 42–43. F.E. 33:615. Fig. 1475 contrasts the lvs. of the American and European species. A great number of varieties are in cult., of which the following are the most remarkable: Var. **péndula,** Lodd. Fig. 1476. With long, pendulous branches, the larger limbs mostly horizontally spreading. G.C. III. 51:114. G.W. 15, p. 662. B.B. 1907, p. 393. Gn. 42, p. 65; 55, p. 267; 64, p. 167. G.F. 1:32 (adapted in Fig. 1476). Gng. 6:258. G.W. 2, p. 15; 9, p. 510; 15, p. 663. G.M. 52:807. Var. **tortuòsa,** Dipp. (var. *suentelién sis,* Hort.). Dwarf form, with twisted and contorted branches and small lvs. M.D.G. 1912:110. Var. **pyramidàlis,** Kirchn. Of pyramidal habit. Var. **purpùrea,** Ait. (var. *atropurpùrea,* Hort.). Fig. 1477. Lvs. purple. M.D.G. 1901:

163; 1908:499. G.C. III. 24:305. F.E. 13:472; 14: 874. A.G. 18:837. G.W. 2, p. 539. A form with very dark purple lvs. and of compact habit is var. **Rìversii**, Hort. There are other forms, differing in the shade of purple, as var. *cuprèa*, Hort., and also some with rosy pink variegated lvs. Var. **purpûrea péndula**, Hort., has

1476. Fagus sylvatica var. pendula.

purple lvs. and pendulous branches, but is of slow growth. Var. **Zlàtia**, Spaeth, has yellow foliage. Var. **heterophýlla**, Loud. (var. *asplenifòlia*, Lodd.). Lvs. deeply cut, often almost to the midrib, into narrow lobes. A very graceful variety, forming a dense and low, shrubby tree. Mn. 1, p. 61. F.E. 18:314. P.G. 3:163. Less important varieties, but sometimes grown, are the following: Var. **cristàta**, Lodd., with deeply toothed, curled, small and clustered lvs.: of slow growth. Var. **incìsa**, Hort. Similar to var. *heterophylla*, but lvs. less deeply cut. Var. **macrophýlla**, Hort. Lvs. large, to 5 in. long. Var. **quercifòlia**, Schelle (var. *quercoìdes*, Hort.). With deeply toothed and sinuate, rather narrow lvs. Var. **quercoìdes**, Pers., often confused with var. *quercifolia*, is a form with dark and rough, oak-like bark. M.D.G. 1909:509.

F. asiàtica, Winkl.=F. orientalis.—*F. Engleriàna*, Seemen. Tree, about 50 ft. tall: lvs. obovate or oval-obovate, glabrous below: stalk of fr. 2–3 in. long, glabrous. Cent. China.—*F. japónica*, Maxim. Lvs. small, elliptic, crenate: involucre small, slender-peduncled, half as long as the nuts. Japan. S.I.F. 1:35.—*F. orientàlis*, Lipsky (F. asiatica, Winkl.). Pyramidal tree: lvs. elliptic to oblong-obovate, nearly entire: lower prickles of the involucre changed into linear-oblong lobes. Asia Minor to N. Persia.—*F. Sièboldii*, Endl. Lvs. ovate, shortly acuminate, crenate, with 9–14 pairs of veins: lower prickles of the involucre changing into slender linear or obovate-oblong lobes. Japan. S.I.F. 1:35.—*F. sinénsis*, Oliver (F. sylvatica var. longipes, Oliver). Tree, about 50 ft. tall: lvs. ovate or rhombic-oval, finely pubescent below: stalks of fr. 1½–2 in. long, pubescent above. Cent. China.

ALFRED REHDER.

FALLÙGIA (after Virgilio Fallugi or Falugi, an Italian botanical writer, end of the seventeenth century). *Rosàceæ*. Ornamental woody plant sometimes cultivated for its handsome white flowers and the attractive heads of feathery tailed fruits.

Deciduous shrub: lvs. alternate, small, 3–7-lobed at the apex, stipulate: fls. 1–3, terminal on elongated branchlets, perfect or polygamous, with 5 narrow bracts inserted between the calyx-lobes; calyx-tube cupular; sepals 5, imbricate; petals 5, suborbicular, yellowish white; stamens numerous in 3 rows; pistils many, on a conical torus, pubescent; style slender: achenes with long persistent plumose styles.—One species in S. W. N. Amer.

This plant is a low divaricate shrub with slender spreading branches, and conspicuous white flowers at the tips of slender branchlets, followed by dense heads of feathery tailed fruits. Hardy as far north as Massachusetts; demands well-drained soil and a sunny warm position; likes limestone soil; stagnant moisture, particularly during the winter, is fatal to it. Its best place is in a rockery of southern aspect. Propagation is by seeds, which are freely produced.

paradóxa, Endl. Shrub, to 3 ft.: lvs. cuneate with 3–7 narrow-oblong lobes decurrent into the linear petiole, revolute at the margin and whitish tomentose below, ⅓–½in. long: fls. 1–3, 1–1½ in. across, white: achenes with feathery tails 1–1½ in. long. June–Aug.; fr. Aug.–Oct. Calif., Nev. and Utah south to Mex. B.M. 6660. M.D.G. 1900:207. ALFRED REHDER.

FARADÀYA (Michael Faraday, famous chemist, 1794–1867). *Verbenàceæ*. Climbing shrubs, allied to Clerodendron, with opposite simple lvs., and fls. in terminal or nodular panicles; corolla tubular, widened upward, with a 4-lobed limb of which one lobe is larger; stamens 4, paired, exserted; ovary 4-lobed and 4-celled: fr. a drupe. There are about a half-dozen species in Austral. and S. Pacific islands. They appear not to be in the trade. *F. splèndida*, Muell., of Austral., may occur in choice collections: it is a tall glabrous climber with ovate, acuminate coriaceous lvs. 6–12 in. long, and large white fls. in terminal panicles.

FARFÙGIUM: *Ligularia*.

FÁTSIA (from a Japanese name). *Araliàceæ*. Half-hardy shrubs or small trees, used for subtropical foliage effects in the North, and planted permanently far South.

Fatsia has 2 species, belonging to the Panax series, in which the petals are valvate, while in the Aralia series they are more or less overlapping, but the sides affixed at the base. Within the Panax series, Polyscias has the pedicel articulated under the fl., while in Fatsia and Acanthopanax the pedicel is continuous with the fl. Fatsia is distinguished from the hardier and less

1477. Good specimen of purple beech.—Fagus sylvatica var. purpurea.

familiar but worthy Acanthopanax by the greater length and distinctness of the styles. This genus is doubly interesting as producing the famous rice paper of the Chinese, and two rivals of the castor-oil plant in bold subtropical effects, made by large lvs., the lobes of which spread out like fingers.

While fatsias require more care in the North than the hardy aralias, their massive subtropical appearance is

highly distinct. A perfect specimen is figured in Gardening 5:133, where W. R. Smith says of *F. papyrifera:* "This plant produces the beautiful substance known as rice paper; it grows to 10 ft. high, with a st. 4 in. diam., full of white pith like the elder; in a full-grown specimen the pith is about 1 in. diam. It is divided into pieces 3 in. long, and by the aid of a sharp instrument is unrolled, forming the thin, narrow sheets known as rice paper, greatly used by the Chinese for drawing figures of plants and animals, and also for making artificial fls. Until about 1850 the source of this substance was unknown to scientists. The Chinese, on inquiry, gave very fanciful figures and descriptions of it. . . . It is destined to be a people's plant, as ½in. of the root will grow and form a good plant the first season. It has survived most winters for the past 5 years in Washington, D. C."

As associates in groups of bold-habited plants, F. W. Burbidge (Gn. 45, p. 321) suggests *Polygonum sachalinense, Chamærops Fortunei* and *Rodgersia podophylla.* For contrast with feathery and cut-leaved foliage, he suggests bamboos, aucubas, cut-leaved maples

1478. Fatsia japonica.

and various ivies. Fatsia may be grown in the temperate house in the North, outdoors southward. It is easily grown and propagated. The species are unarmed; the very spiny plant sometimes referred to this genus as *F. horrida,* is treated under Echinopanax, which see. Siebert and Voss declare that most of the plants sold as *Fatsia japonica* are *Aralia spinosa.* These plants like shade. Full sunlight for an hour or two in early morning is enough. They should have a shelter-spot, where the wind will not whip their foliage.

papyrífera, Benth. & Hook. (*Arália papyrífera,* Hook. *Tetrapánax papyríferum,* Koch.). Height 5–7 ft. (according to Franceschi, 20 ft. in the open ground in S. Calif.): branches and young lvs. covered with stellate, more or less deciduous down: mature lvs. reaching 1 ft. long, cordate, 5–7-lobed; lobes acute, serrate; sinus very deep: fls. inconspicuous, white, in sessile, globose clusters. Formosa. B.M. 4897. A.F. 7:385. Gng. 5:133. Gn. 45, p. 321.

japónica, Decne. & Planch. (*Arália japónica,* Thunb., not Hort.? *A. Siéboldii,* Hort.). Fig. 1478. Lvs. downy at first, finally shining green: fls. in umbels. Japan, China.—Abroad are cult. forms with white or golden margins and a form reticulated with gold markings. Var. **Mòseri,** Hort., is regarded as an improved, more compact-growing variety which originated with Moser of Fontainebleau. Intro. into Amer. by Montarioso Nurseries, Santa Barbara, Calif.

WILHELM MILLER.
N. TAYLOR.†

FÈDIA (application doubtful). *Valerianàceæ.* One glabrous branching annual of the Medit. region, sometimes grown as an ornamental and also as a salad plant. Lvs. entire or dentate: fls. red, small, in more or less dense terminal cymes; peduncles thick and fistular; corolla with an elongated tube and a 2-lipped limb, irregular at the base; stamens 2; style entire or 2–3-fid. *F. Cornucòpiæ,* DC. (*Valeriàna Cornucàpiæ,* Linn.), a variable species, usually with purplish sts., grows 10–16 in. high: lvs. nearly all radical, oval-oblong, shining green. It is sometimes known as African valerian. The lvs. are eaten as salad, being related to corn-salad. The plant seems not to be in the American trade.

FEIJÒA. The FEIJOA, or PINEAPPLE GUAVA (*Feijòa Sellowiàna,* Berg, family *Myrtàceæ*) is indigenous to western Paraguay, southern Brazil, Uruguay, and parts of Argentina, where it is common in the forests, and the fruit is highly esteemed by the natives though not cultivated. It was introduced to southern Europe in 1890, and is grown along the Riviera, both in France and Italy. From the former country it was introduced to the United States about 1900, and is becoming widely planted in California. Its distribution in other countries is very limited.

Feijoa is of 2 species. It is the Orthostemon of Berg, not of Robert Brown. *F. obovàta,* Berg (*O. obovàtus,* Berg), is considered by Niedenzu to be a variety of *F. Sellowiana.* It is a white-tomentose shrub, with bisexual showy fls.; petals 4, spreading; stamens numerous, in many series, colored; ovary 4-celled, bearing a thickish style; pedicels 1-fld., at the ends of the branches or becoming lateral. The other species is *F. Schenckiàna,* Kiaersk., of Brazil, described first in 1891. The genus is closely allied to Psidium, but is distinguished by the albuminous seeds and stamens suberect in the bud.

The plant grows to an ultimate height of 15 feet. Its leaves are similar in form and appearance to those of the olive, but larger, the upper surface glossy green, and lower surface silvery gray, forming a contrast that makes the shrub effectively ornamental. This effect is much heightened by its flowers which are produced in late spring and are 1½ inches in diameter, composed of four cupped petals, white outside and purplish crimson within, surmounted by a tuft of crimson stamens 1 inch long. The oval or oblong fruits, 2 inches in length and 1½ inches in thickness, ripen in autumn and early winter. The skin is dull green, with sometimes a touch of crimson on the cheek; it incloses a layer of whitish, granular flesh, which surrounds a quantity of translucent, melting pulp, containing twenty to thirty seeds. The flavor bears a pronounced resemblance to that of the pineapple, this being enhanced by the fact that the seeds are so small that they cannot be felt in the mouth. While commonly eaten fresh, the fruit may be cooked in several ways, crystallized, or made into jam or jelly.

The feijoa does not seem to thrive under strictly tropical conditions, preferring a climate such as that

of southern California or the Riviera, free from excessive humidity, and cool at least part of the year. In France, the plants have passed uninjured through temperatures of 12° F. A good loam, rich in humus, is the ideal soil for the feijoa. It has been successfully grown on heavy clay, by working in a quantity of light material, but it does not do well on light or sandy soils. The situation seems to be of little importance, provided the land is well drained. While the plant is notably drought-resistant, for best results in growth and fruiting a liberal supply of water is necessary. During the dry season, irrigations should be as frequent as for citrous trees. Fertilizers must be applied with caution, or they will stimulate growth at the expense of fruit. A small quantity of bone-meal, or other fertilizer not too rich in nitrogen, may be advantageously applied each year, while well-rotted manure will supply the much-needed humus, if it is lacking in the soil. The plants should be set 15 or 18 feet apart, and require very little pruning. Seedlings usually come into bearing at three to five years; grafted or layered plants will sometimes bear the second year.

In some instances, seedling feijoas fruit sparingly or not at all, either through the failure of the flowers to be properly fertilized or because of unfavorable soil or surroundings. Although isolated plants are often productive, it has been suggested that the feijoa is sometimes self-sterile, and two or more bushes should be planted together to permit of cross-pollination. The difficulty can probably be obviated, in a measure at least, by propagating asexually from strains of known productiveness.

The fruits fall when mature, and must be laid in a cool place until they are in condition for eating, which can be detected by a slight softening, and also by the odor,—a fragrance most delightful. If picked before fully mature and ready to fall, the fruits lack much of the delicate flavor of a perfectly ripened specimen. Very little care is required in packing, and the fruits can be shipped long distances without difficulty. They spoil quickly in a hot, humid atmosphere, but if stored in a cool place they can be kept for a month or more in perfect condition.

The shrub is attacked by a very few insects, the only one noted in either California or southern Europe being the black scale (*Saissetia oleæ*), which rarely requires combative measures. No fungous diseases have been observed on mature plants.

Propagation is usually by seed, but some vegetative means must be used to perpetuate named varieties. Fruits for seed should be selected with a view to desirability in every character, as in precocity of bearing and productiveness of the parent. While the feijoa does not come absolutely true from seed, fairly good results are usually secured from selected seeds.

One of the best mediums for germinating the seeds is a mixture of silver-sand and well-rotted redwood sawdust. This gives an almost sterile medium, in which there is little danger of damping-off, to which fungus the young plants are very susceptible. With care in watering, however, any light porous soil, not too rich in humus, may be used. Sow the seeds in pans or flats, covering them to the depth of ¼ inch. Germination will usually take place within three weeks. A glass-house is not necessary, but the flats containing the seeds should be kept in a frame with lath or slat covering to provide partial shade. The seeds will retain their vitality a year or more, if kept dry. As soon as the young plants have made their second leaves they should be pricked off into 2-inch pots; after attaining a height of 4 inches they should be shifted into 3-inch pots, from which they can later on be transplanted into the open ground.

Cuttings can be successfully rooted under glass. They should be of young wood from the ends of branches, and about 4 inches in length. Inserted in clear sand over bottom heat they will strike roots in a month or two; without bottom heat they root very slowly. It is sometimes advised to keep them covered with bell-jars until they have formed roots.

Layering is used in France to perpetuate choice forms. It is somewhat tedious, but more certain than any other vegetative means of propagation. Those branches which are closest to the ground are bent down and covered with soil for the space of 3 to 6 inches. They require no care except to keep the soil fairly moist, and they will root in six months.

Whip-grafting and veneer-grafting are successfully practised under glass, using as stocks seedling feijoas of the diameter of a lead pencil. The cions should be of about the same diameter and of young but firm wood.

Several named varieties have been established, of which the most prominent are André and Besson.

F. W. Popenoe.

FELÍCIA (for Herr Felix, a German official). *Compósitæ*. Herbs or sub-shrubs, grown under glass or as pot specimens.

Leaves alternate, entire or dentate: heads usually long-peduncled, the corolla blue or white, the disk yellow. Much like Aster, from which it differs in having pappus bristles in one series, and in other technical characters.—Forty to 50 species in Afr.

1479. Blue daisy.—Felicia amelloides. (×½)

amelloìdes, Voss, not Schlechter 1898 (*Cinerària amelloìdes*, Linn. *Áster rotundifòlius*, Thunb. *A. capénsis*, Less. *Agathæa cœléstis*, Cass. *A. rotundifòlia*, Nees. *A. amelloìdes*, DC.). Blue Daisy. Blue Marguerite. Fig. 1479. An old greenhouse plant, 1–2 ft., with roundish ovate opposite lvs. and large, solitary heads of an exquisite sky-blue. S. Afr. B.M. 249. A.F. 13:657. F.R. 1:674. Gng. 6:149.—There is a variegated-lvd. variety (I.H. 8:296). Grown easily from cuttings. Handled like a cineraria; or, if grown from spring cuttings for winter bloom, like a chrysanthemum, but with more heat in the fall. An elegant pot-plant, and useful for bedding in a protected place. Var. **monstròsa**, Hort. Fls. double the size of the type.

petiolàta, N.E. Br. (*Áster petiolàtus*, Harvey). An undershrub more or less prostrate and useful for hanging-baskets: lvs. obovate or lanceolate, wedge-shaped at the base, rather papery: fls. at first rose-colored, gradually changing to aster-blue. S. Afr. B.M. 8370. F.E. 33:503. G.C. III. 42:82.—Intro. in S. Calif. in 1912.

N. Taylor.†

FENDLÈRA (after Augustus Fendler, a German naturalist, botanical explorer of New Mexico). *Saxifragàceæ*. Ornamental woody plant grown for its handsome white flowers.

Deciduous shrub: lvs. opposite, short-petioled, entire, 3-nerved: fls. solitary or rarely 2–3 at the end of short lateral branchlets; calyx-lobes and petals 4; stamens 8; ovary almost superior: fr. a 4-celled, dehis-

cent caps., with flat, oblong seeds.—Two species from Texas to Mex. Allied to Philadelphus, but differing in its 8 stamens and superior ovary. They are graceful ornamental shrubs with small, grayish foliage, covered in June along the slender, arching branches

1480. Fendlera rupicola. (×⅔)

with graceful white fls., resembling in shape a Maltese cross. Hardy in New England, and growing best in a well-drained, sandy or peaty soil and sunny position. A very handsome and graceful plant for sunny rockeries or rocky slopes. Prop. by seeds or by greenwood cuttings under glass.

rupícola, Engelm. & Gray. Fig. 1480. To 4 ft.: lvs. linear-lanceolate or linear-oblong, 3-nerved, revolute at the margin, grayish tomentose beneath, ½–1 in. long: fls. milky white, 1 in. across; petals rhombic-ovate, with distinct claw, spreading; stamens erect. June. G.F. 2:113 (adapted in Fig. 1480). G.C. III. 36:410. B.M. 7924. R.H. 1891, p. 42; 1899, p. 129. M.D.G. 1899:231. G. 28:601. ALFRED REHDER.

FENNEL. Species of *Fœniculum* (Umbelliferæ), annuals or treated as such, used as salad or condimental herbs. Native of southern Europe. The common fennel (*F. officinàle,* Linn.) is grown mostly for its young leaves, which are used in flavoring, and also for its aromatic seeds. Leaves sometimes eaten raw. Sow seeds in late fall to ensure early germination in spring, or sow in early spring. In any good soil, the plant comes to maturity quickly. This plant has become in California one of the most widely naturalized European weeds. It is a pest in pastures, said at times to attain 12 or 15 feet.

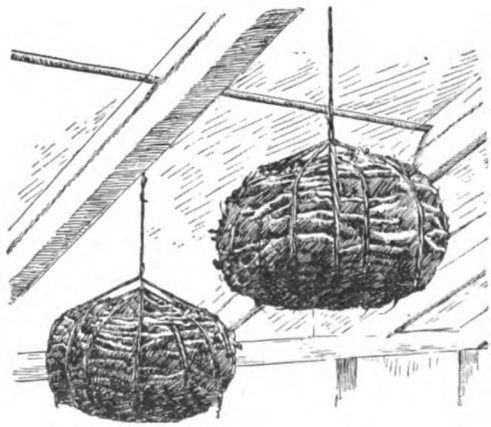
The Florence or sweet fennel is *F. dulce,* DC. The bases of the crowded leaf-stalks are much thickened, making a bulb-like enlargement above the ground. This thickened base has an oval form in cross-section. Earthing-up blanches these thickened leaf-bases, and after boiling they are fit for eating. A good fennel bottom may be 3 or 4 inches high. This is an Italian vegetable, but is in the American trade. Easily cultivated annual; matures quickly. Sow in spring, and later for succession.

Giant fennel is cultivated for ornament, and is described under *Ferula.* Fennel-flower is a name of Nigella. L. H. B.

FENUGREEK (*Trigonella Fœnum-Grœcum,* literally Greek hay). An annual legume indigenous to western Asia, cultivated for human food, forage, and for medicinal qualities; widely naturalized in Mediterranean countries; little grown in America.

Fenugreek is an erect little-branched plant with 3-foliolate leaves. The seeds are 1 or 2 lines long, brownish yellow and marked with an oblique furrow half their length. They emit a peculiar odor, and contain starch, mucilage, a bitter extractive, a yellow coloring matter, and 6 per cent of fixed and volatile oils. As human food they are used in Egypt, mixed with wheat flour, to make bread; in India, with other condiments, to make curry powder; in Greece, either boiled or raw, as an addition to honey; in many oriental countries, to give plumpness to the female human form. The plant is used as an esculent in Hindostan; as an early fodder in Egypt, Algiers, France, and other countries bordering the Mediterranean. Formerly the seed was valued in medicine; now it is employed only in the preparation of emollient cataplasms, enemata, ointments and plasters, never internally. In veterinary practice it is still esteemed for poultices, condition powders, as a vehicle for drugs, and to diminish the nauseating and griping effects of purgatives. It is commonly used by hostlers to produce glossy coats upon their horses and to give a temporary fire and vigor; by stockmen to excite thirst and digestion in fattening animals; by manufacturers of patent stock foods as a flavoring ingredient.

Fenugreek does not succeed on clays, sands, wet or sour soils. It yields most seed upon well-drained loams of medium texture and of moderate fertility; most fodder upon rich lands. For seed-production, potash and phosphoric acid should be applied; for forage, nitrogenous manures. Deep plowing and thorough harrowing are essential. Ten to twenty pounds of seed should be used broadcast, or seven to ten pounds in drills 18 inches apart. Thinning when the plants are 2 or 3 inches tall, and clean culture throughout the



1481. Fern-balls as received from the dealer.

season until blossoming time, are necessary for a seed crop. The crop may be mown, dried and threshed four or five months after seeding. An average yield should be about 950 pounds an acre. As a green manure, fenugreek is inferior to the clovers, vetches and other popular green manures of this country. It possesses

the power of obtaining nitrogen from the air by means of root-tubercles.—For description of the plant, see *Trigonella*. M. G. KAINS.

FÊNZLIA: *Gilia.*

FERDINÁNDA: *Podachænium.*

FERN-BALLS (Fig. 1481) are the dried rhizomes of ferns, imported from Japan. Dealers often start them into growth, and sell them when the mass is well covered with its delicate vegetation. To start them into growth, the balls are drenched in a tub of water and then hung in a warmhouse, not in direct sunlight. When the plants are well started, gradually expose them to more light and to a cooler air. Give liquid manure if they do not grow satisfactorily. The species are mostly Davallias, apparently *D. bullata* and *D. Mariesii*.

Fern-balls (*Davallia bullata*) are of Japanese origin. They are natives of deep mossy forests (the mosses on trees as well as on the ground), with abundant humidity in the air, as in Kiso or some parts of

1482. Ferns in formal shapes.

Fukushima districts. Toward the end of every winter, an expert goes into these forests and gathers the vines of such ferns. They should be carefully kept in the bamboo baskets in which a large quantity of mosses are contained, which must be sprinkled with water on the way to the metropolis. The people outside of large towns or cities do not care much for this plant. When the plants arrive in the cities or towns, they fall into the hands of gardeners who make many shapes with the vines (Fig. 1482). This is done before any leaves appear. Then the balls or other shaped articles are hung from the ceiling beam quite near to its end but not exposed to rain or hot sunshine. The ferns should not be subjected to pouring rain or showers, although they like dew. They should have some sprinkling of cool water once every day after sunset. The plant dislikes dust or warm impure water. The best fertilizer is the extract of fish-meal or cake ("abura-kasunazumi"). Prices run from 20 cents to 50 cents United States money according to the shape of balls and general excellence. (Issa Tanimura.)

FERNÈLIA (Jean François Fernel, 1497–1558, physician to Henry II of France). *Rubiàceæ*. Four small evergreen trees or shrubs of the Mascarene Isls., rarely grown in choice warmhouse collections. Lvs. small, opposite, coriaceous, short-stalked, ovate-oblong or nearly orbicular: fls. small, solitary or in 2's, provided with a 4-toothed calyx-like involucre; corolla short-tubed, salver-shaped, with 4 spreading lobes; stamens 2, affixed in the corolla-throat; disk annular; ovary 1-celled below and 2-celled above: fr. a small berry. *F. buxifòlia*, Comm., is the species likely to be in cult. It is a much-branched shrub 4–5 ft. high, with obovate or oblong lvs. ½in. or less long, and many whitish fls. in the axils of the lvs.: berry dry, size of a pea, red, borne inside the involucre. Mauritius. L. H. B.

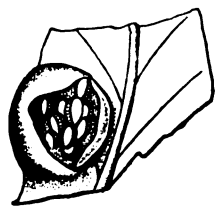
FERNS. The plants included under this name comprise an entire order, made up of several distinct families. They include plants varying in size from a hair-like creeping stem bearing a few simple, moss-like leaves, to tall trees 80 or more feet in height, with a stem or trunk nearly a foot in diameter. Singularly enough, the extremes in size are both found in tropical regions, in which most of the species abound. Most of the ordinary native species, as well as the larger part of those in cultivation, consist of an erect underground stem or rootstock with leaves, often called fronds, clustered in dense crowns, or in the cases of creeping stems with scattered leaves. In gardening parlance, other plants are sometimes called ferns, as species of lycopodium and selaginella, as well as *Asparagus plumosus*.

1483. Sporangium or spore-case of a fern.

In the life of an individual fern plant, two distinct phases occur, represented by two separate and unlike plants. The ordinary fern plant represents the asexual phase of growth (*sporophyte*), producing its spores normally in spore-cases (*sporangia*, Fig. 1483), which are borne in masses (*sori*, Fig. 1484) on the back or margin of the leaf, or in a few cases are grouped in spikes or panicles, or in rare cases spread in a layer over the entire under surface of the leaf. The sexual stage (*gametophyte*) develops from the germinating spore, and consists of a tiny usually scale-like green heart-shaped prothallus (Fig. 1485), which bears the sex-organs (*archegonia*, female, and *antheridia*, male) on the under surface. After fertilization in the archegonium, the egg develops directly into a young fern plant (Fig. 1485). Many ferns also propagate vegetatively by runners or offsets, by bulblet-like buds, and in certain species the tips of the leaves bend over and take root, as in our common walking-leaf (Camptosorus, which see).

Ferns frequently hybridize. The crossing takes place naturally in the prothallium stage. They are not crossed by hand, as are the seed-plants, but from the accidental mixing when prothallia of allied species are growing together. Fig. 1486 (G.F. 9: 445) is a hybrid between two native species; it has been found in the wild in several parts of New England.

Great diversity has existed in the matter of the separation of the ferns into genera. Hooker, relying mainly on artificial characters drawn largely from the sorus, recognized about seventy genera only, many of them heterogeneous groups of plants with little resemblance in structure, habit or natural affinities. John Smith, relying on stem characters, Presl on variation in venation and habit, Fée, Moore,



1484. A sorus or fruit-dot of a fern.

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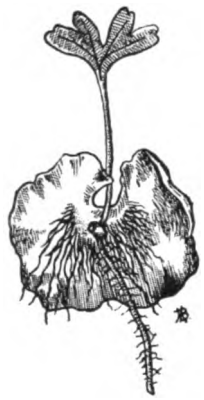
and others, have recognized a much greater number of genera, ranging from 150 to 250, or even more. In the very unequal treatment by Diels in Die Natürlichen Pflanzenfamilien (Engler & Prantl), some 120 genera are recognized. A somewhat similar difference prevails in regard to the number of species. The Synopsis Filicum of Hooker and Baker (1874), supplemented by Baker's New Ferns (1892), recognizes some 2,700 species. It is the too prevailing tendency in this work (1) to fail to recognize many valid species which have been described by German and French botanists, and (2) to mass under one name very diverse groups of species from distant quarters of the world—from 8 to 10 species not infrequently appearing as a single so-called "variable species." The most recent book dealing with the whole order of ferns, the Index Filicium by Carl Christensen, recognizes approximately 150 genera and 6,000 species, and this number is continually increased as the result of further tropical exploration and more careful study. New forms are constantly coming in from the less-explored parts of the world, and within the last few years several new species have been described from the United States, including some from the better-known parts. Of this number some 200 species are in occasional cultivation in America, but the species that form the bulk of the fern trade do not exceed two dozen. In Europe several hundred species have long been in cultivation. Most of the species thrive best in the mountain regions of the tropics, the mountains of Jamaica and Java having nearly 600 species each, and the Andes also a large number. About 165 species are native in the temperate United States, representing some thirty-five genera; our native species are so widely distributed that usually not more than twenty-five to fifty will be found within the limits of one state, and the common species of the best locality do not number more than twenty. Recent explorations in southern Florida have discovered in that state the presence of a considerable number of West Indian species not found elsewhere in the United States.



1485. Prothallus of a fern, with a young leaf arising.

The ferns are commonly classified as part of a group of spore-bearing plants, with vascular (woody) tissue in stem and leaves; this group is technically known as the Pteridophytes, and is ordinarily divided into three orders; viz., the **Equisetales,** including the horsetails and scouring rushes; the **Lycopodiales,** including the selaginellas and the club mosses, or ground pines; and the **Filicales,** including the true ferns and their nearer allies (see pp. 7–9, Vol. I). The Lycopodiales and Equisetales are really not as closely related to ferns as this grouping would indicate.

It should be noted that neither the family nor the generic limitations are in a settled condition. The researches of Bower, Lang, Jeffrey, and others have resulted in some changes of classification which are not included below because they are not complete enough. Their conclusions are undoubtedly correct but are not at present usable.

The families of the order **Filicales** may be distinguished as follows:

A. *Spores of one sort.* (*Isosporous.*)

B. *Sporangia fleshy, with no ring, rising from the interior tissues of the lf.* (*Eusporangiate ferns.*)

1. **Ophioglossàceæ.** Adder's-Tongue Ferns. Herbaceous small ferns with the sporangia borne in spikes or panicles on highly modified divisions of the large fleshy foliage lvs.; prothallium tuberous, subterranean, without chlorophyll.

2. **Marattiàceæ.** Coarse ferns with large fleshy sporangia on the under surface of the lf., arranged in circular or boat-shaped receptacles; prothallium above ground, green.

BB. *Sporangia rising from an epidermal cell, with an elastic ring of peculiar cells, which assist in scattering the spores by rupturing.* (*Leptosporangiate ferns*).

C. *Lvs. filmy, usually only 1 cell thick between the veins.*

3. **Hymenophyllàceæ.** Filmy Ferns. Sporangia attached to a thread-like receptacle arising in a cup at the end of the lf.: ring complete, horizontal or oblique.

CC. *Lvs. herbaceous or leathery.*

D. *Ring incomplete or rudimentary: sporangia in panicles.*

4. **Osmundàceæ.** Flowering Ferns. Coarse swamp ferns developing copious green spores early in the season: sporangia in panicles at the apex or middle of the lf. or on separate lvs.

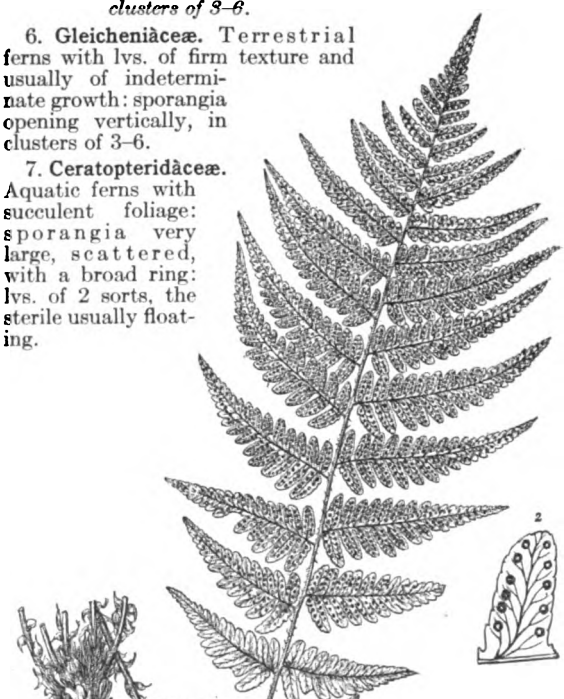
DD. *Ring apical: sporangia usually single under a scale, or in panicles.*

5. **Schizæàceæ.** Upright or climbing ferns with ovate sporangia, which open vertically.

DDD. *Sporangia sessile, either single or in clusters of 3–6.*

6. **Gleicheniàceæ.** Terrestrial ferns with lvs. of firm texture and usually of indeterminate growth: sporangia opening vertically, in clusters of 3–6.

7. **Ceratopteridàceæ.** Aquatic ferns with succulent foliage: sporangia very large, scattered, with a broad ring: lvs. of 2 sorts, the sterile usually floating.



1486. An example of a fern hybrid.—Dryopteris cristata × D. marginalis.

DDDD. *Sporangia numerous, collected in definite clusters (sori).*

8. **Cyatheàceæ.** Mostly tree ferns with sessile or short-stalked sporangia in conspicuous receptacles, opening obliquely (Fig. 1179, Vol. II).

9. **Polypodiàceæ.** Ferns with stalked sporangia (Fig. 1483), which burst transversely: sori covered with a membranous indusium or sometimes naked. This family contains three-fourths of all the ferns.

AA. *Spores of two sorts: minute microspores and conspicuous macrospores. (Heterosporous.) These spores develop into two sorts of prothalli, those from the microspores developing only antheridia, and those from the macrospores only archegonia.*

10. **Marsiliàceæ.** Small plants rooting in mud, the lvs. either quadrifoliate or reduced to mere filamentous petioles: sporangia borne in oval conceptacles on the leaf-stalks. Often aquatic, with the leaves floating on the surface of water in pools or lakes.

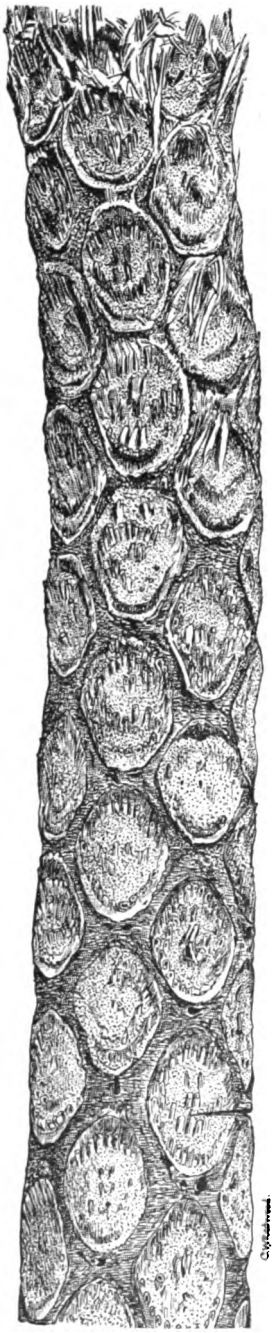
11. **Salviniàceæ.** Small or minute plants with the aspect of liverworts, floating on the surface of pools: sporangia in mostly spherical conceptacles.

The literature on the ferns is very extensive, since they have ever been attractive plants in cultivation. Many of the species have been illustrated in elaborate treatises by Schkuhr, Kunze, Hooker, Greville, Blume, Fée, Mettenius, Moore, and others. Our native species have been illustrated in the two quarto volumes of D. C. Eaton, "The Ferns of North America." A valuable summary of the more common fern species is found in Dr. Christ's "Die Farnkräuter der Erde" (1897), and a recent structural and morphological treatment is by Sadebeck, in Engler & Prantl: "Die Natürlichen Pflanzenfamilien." Schneider's "Book of Choice Ferns" is the most complete treatise on the species under cultivation. A useful American horticultural manual is Robinson's "Ferns in Their Homes and Ours." An excellent little handbook for the wild species of this country is Underwood's "Native Ferns and Their Allies."

L. M. UNDERWOOD.
R. C. BENEDICT.†

Tree ferns.

The term "tree fern" is applied commonly to ferns of the family Cyatheaceæ, to distinguish them from species of other families of ferns which, for the most part, are not at all arborescent. A comparatively small number of Cyatheaceæ, it is true, have the trunk short, and oblique or decumbent; but in most species the trunk is erect and greatly elongate (commonly 3 to 40 feet high) and the whole plant so unmistakably tree-like in size and proportion, that the name "tree fern" is a most appropriate one for the family. The leaves are usually large and are borne in a radiating palm-like crown at the apex of the trunk, or caudex, as it is often called. The trunk itself, in the case of an ordinary mature individual, is marked by numerous close-set leaf-scars (Fig. 1487); these serve to indicate not only the relatively great age of the plant but its slow rate of continuous development, as well.



1487. The trunk of a tree fern.—*Cyathea arborea.*

Tree ferns are primarily forest dwellers and occur either as component parts of the dominant forest growth or, more commonly, as a sort of thicket or "under-forest" association in moist partial shade beneath the crowns of the higher forest trees. They are nearly confined to wet tropical mountain slopes which are not subject to drought or pronounced seasonal change; they reach, therefore, their best development, both as to species and number of individuals, upon lofty mountains and upon the seaward side of ranges which are drenched constantly by cool moisture-laden winds from the ocean.

The successful cultivation of tree ferns under glass is predicated upon these facts, although not all the species here mentioned are horticulturally known in this country. It is found that most species should be grown at a temperature of about 60° F. and in a rather shallow soil; that a continuously wet but well-drained substratum is essential; and that in general a tolerably high atmospheric humidity also is requisite for best growth. Very bright sunlight must be guarded against in all but a few species, among these being the common tropical American *Cyathea arborea*, which grows naturally in rather open places, and *C. furfuracea*, a native of Cuba and Jamaica which assumes a not unattractive form in drier open situations. As in other groups of ferns, there are certain species which demand unusual care and minor variations of treatment, such as wrapping the trunk in sphagnum as a safeguard against drying out. These special requirements can be determined only by experience.

The Cyatheaceæ are divided technically into three tribes: Thyrsopterideæ, Dicksonieæ, and Cyatheæ. The first mentioned consists of a single species, *Thyrsopteris elegans*, Kunze, from Juan Fernández. The two latter tribes may be distinguished as follows:

Sori terminal upon the veins, at or near the margin of the segments; indusia at least bilobed, the outer lip formed of the more or less modified lobule of the leaf..... **Dicksonieæ.**
Sori borne upon the back of the veins; indusium (if present) not formed of the leaf-margin in any part.. **Cyatheæ.**

The Dicksonieæ consist of three genera: Culcita (often known as Balantium), with about six species, all of small stature and nearly devoid of trunk; Dicksonia, with five tropical American species and several hardy Australasian species, the latter not uncommon in cultivation and capable of enduring unusually great extremes of cold; and Cibotium, with four North American species and several which occur in Asia and the islands of the Pacific. (See under *Cibotium* and *Dicksonia*.)

It is in the Cyatheæ, however, that the greatest variety and extremes of leaf form are noted, and consequently the species of this tribe are most highly esteemed in cultivation. They are commonly associated under three genera: Cyathea, Alsophila, and Hemitelia, distinguished mainly by characters of the indusia. One

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of the most graceful species of all is *Cyathea arborea*, introduced into England from the West Indies by Admiral Bligh in 1793. There are numerous species almost equally fine, many of which are not in general cultivation. The species with clean trunks, from which the leaves are freely deciduous after maturity, are the most pleasing; and among those which deserve especial notice are the following: *Cyathea minor*, a very slender Cuban plant with trunk 6 to 12 feet high and 1 to 1½ inches thick, its several slender bipinnate leaves borne in a spreading crown; *C. portoricensis*, a tall Porto Rican species with large nearly tripinnate leaves, its rachises dark, lustrous, purplish brown; *C. elegans*, of Jamaica, a close ally of *C. arborea*, often attaining a wide spread of leaf at an unusually early age; *C. Werckleana*, *C. hemiotis*, and *C. hastulata*, of Costa Rica, a peculiar subgroup characterized by having the leaves fully tripinnate, the ultimate rachises discontinuously alate; *C. divergens*, extending in one form or another from the Andes to Costa Rica, its huge fronds exceedingly lax and sometimes even in large plants recurved nearly to the ground; *C. insignis* of the Greater Antilles, in technical characters allied to the well-known *C. princeps* of Mexico; *C. suprastrigosa* and *C. conspersa* of Costa Rica and Panama, delicate graceful tripinnatifid plants of the high mountains; *C. punctifera* of Nicaragua and Costa Rica, a plant of lower range, its huge tripinnatifid fronds remarkably beautiful from the strong contrast afforded by the slender rich brown rachises and the unusually vivid green leaf-segments; *C. aureonitens* of Costa Rica and Panama, a lofty plant with leaf-scars in distant zones, having the unusual habit also of shedding piecemeal all its large tripinnatifid fronds, seasonally.

Of Alsophila, the two best-known species in cultivation are doubtless *A. australis* and *A. aspera*, the latter a common West Indian plant. *A. myosuroides*, of Cuba, Mexico, and Central America, has lately been reintroduced to cultivation. It is a remarkably handsome plant, its rather harsh, heavy, gray-green, tripinnatifid leaves borne from a copious mass of slender, glossy brown scales. Another beautiful species, *A. Salvinii*, from Mexico and Guatemala, has very large tripinnate fronds, with woody castaneous rachises in striking contrast. A favorite species in cultivation also is *A. quadripinnata* (*A. pruinata*), native in the West Indies and from Mexico to Chile, its short trunk bearing huge four-pinnate fronds, bluish or silvery white beneath.

The genus Hemitelia includes not only plants of the above sort, with tripinnatifid fronds (as, for example, the well-known *H. capensis*), but also plants of a distinctly different type known as the subgenus Cnemidaria. These are *H. horrida*, of the West Indies, and numerous related species of the American tropics, many of which have long been cultivated in European conservatories. They are characterized mainly by short trunks and large, leafy, simply pinnate or bipinnatifid fronds, and make a beautiful display in cultivation. Among them may be mentioned *H. speciosa*, *H. bella*, *H. grandifolia*, (*H. insignis*), *H. spectabilis*, and *H. subincisa*. Their characters have recently been discussed at some length. (See Contr. U. S. Nat. Herb. 16:25–49, 1912.)

Considering the wealth of material available in the American tropics and the comparative ease with which it may be secured, it is remarkable that so little attention has been given to the introduction of recently described species. The novelty and beauty of many of these render an effort to this end exceedingly desirable and advantageous from a horticultural point of view. Costa Rica in particular has yielded many interesting new species within late years. This region, which has been called the richest in the world, will doubtless be equaled by certain parts of the Andes of South America, when that immense territory shall have been adequately explored. WILLIAM R. MAXON.

Cultivation of tender ferns.

To grow commercial varieties of ferns profitably, the first care should be to secure the necessary number of properly built and equipped houses, with a conveniently arranged workshop. The house which gives the most general satisfaction runs north and south, has an even-span roof, and with a fall to roof of 6 inches to the foot. Its benches should be arranged to be about 7 feet wide, with a 24-inch path on either side. In an 18-foot house this will permit of having a 7-foot center-table, two 3½-foot side benches and two 24-inch paths. Benches should not be more than 3 feet above the walks, as this will bring every part of the bench within easy reach, and will permit of every plant being in constant sight and easily cared for, which fact is essential in the profitable cultivation of trade ferns.

The width of house is immaterial, but when houses adjoin, a width of 27 feet has been found to be very satisfactory, as this permits the construction of three 7-foot benches, two 24-inch paths, and two paths 2½ feet wide under each gutter.

Thorough provision should be made for ventilation. For a 27-foot house, a continuous row of ventilators of at least 3 feet in width should be provided, with some reliable apparatus for raising same. Heating is the next important consideration. Either steam or hot water will give equally good results if properly installed. The safest way for the average grower is to give the heating contract to some reliable firm. Water-taps should be so arranged that a 25-foot hose attached to same will easily reach any part of the house. A 25-foot hose can easily be carried about without injuring either itself or benches and plants; and iron pipe is of only half the cost of good hose. In most fern-houses drip is a source of great annoyance, and should be prevented by the use of drip-bars, by having a drip-groove plowed into the headers immediately under the ventilating-sash, and also by having a groove in sides of gutter-plates. This very slight additional expense will very soon pay for itself by saving a great number of plants, especially when growing very small ferns in houses, such as have been transplanted from spore-pots into boxes. Ventilators should fit into a groove in ridge of house and be hinged to the ridge. When ventilators are so arranged, air, which is very desirable on a good many warm rainy days in the summer, can be given without having plants in the houses suffering from excessive moisture. Burning of the foliage will also be avoided, as the plants will at no time be exposed to the direct rays of the sun. Ventilators hinged on header and opening on ridge will always give trouble. No matter what kind of covering is put over the opening, if it efficiently excludes the burning sun's rays it will also prevent the ingress of air.

A propagating-room should be provided; and in the case of general trade ferns raised from spores, it is a very safe rule to calculate on having from 60 to 70 square inches of room in the propagating-frame for every 1,000 plants desired. The propagating-frame should be 3½ feet wide, have sides 9 inches high, and, to insure an even moisture, its bottom should be covered to the thickness of 1 inch with fine cinders with the fine ashes removed, which make very clean and efficient drainage material. The frame should be covered with light sash constructed with drip-bars, to carry off condensation.

Shading of fern-houses should have close attention. It is best effected by the application of a suitable wash to the outside of glass on roof. The following composition for a wash has given excellent results for a number of years: To two gallons of benzene or turpentine add one pint (or more, according to time the shading is desired to remain on houses) of linseed oil, five pounds of pure white lead and enough whitening to make proper thickness (which can very easily be ascertained

by applying some of it to a piece of glass while adding the whitening); thoroughly mix and apply to outside of glass with a soft brush of the same width as glass. This shading, by the addition of more or less linseed oil, may be made to stay on houses up to one year. If properly applied in spring, it will be just right during the hot days of summer, and in the fall and winter, when more light is gradually required, the frosts gradually will have reduced the shading, thus admitting more light at the necessary time.

Much time, annoyance and expense will be saved by a careful arrangement of the workshop, or potting-room, a thing which in most cases is totally neglected. It should be so built that potting-benches are about 3 feet above the floor and 5 feet wide. They may be permanently constructed of substantial material, in order that a number of pots of different sizes can be conveniently stored, and that potting material can be thrown from cart or wagon directly onto potting-benches. By an improper arrangement of workshop great expense, loss of time and material are incurred by having to handle material repeatedly in small quantities.

Propagation by means of spores.

To grow ferns from spores successfully, it is advisable to sterilize soil on which they are to be sown, which can best be done by subjecting it to a high temperature by means of steam under a pressure of ten to fifteen pounds; and for this purpose a properly equipped workshop should be provided with a tight box about 3 by 3 by 8 feet or larger if an uncommonly large number of ferns is to be grown. It should be fitted with a grating made of 2-inch laths spaced 1 inch apart and placed 2 inches from bottom of the box. This grating may be covered with burlap, and if a ¾-inch steam pipe is fitted between bottom of box and grating, and connected to highest point of steam boiler (to insure getting perfectly dry steam), the soil is ready to be sterilized. After having cooled off, the soil is in practically the same condition as before so far as moisture, friableness, and the like are concerned, and this cannot be said of soil that has been sterilized by burning and by other methods. This steaming process will effectually destroy all forms of life in the soil and leave it for the use of spores alone. In most localities, the water used for moistening spores is impure and full of the spores of low forms of plant life, which are very destructive to the prothalli of ferns. To prevent this, the workshop should be provided with a receptacle in which the water intended for use on ferns while in the prothallus state can be raised to a boiling temperature, which will effectually destroy all spores that may be present in the water. This is best done by leading a 1-inch steam-pipe to within 6 inches of the bottom of the receptacle and turning on a reasonable pressure of steam. If boiled twelve hours before intended for use, it will be cool enough to be applied, and will be pure. A fern workshop should also be provided with a dry closet, having a number of shelves about 12 inches apart, for storing fern-spores.

In beginning the cultivation of ferns, it is advisable to purchase the spores from some reliable firm which makes fern-growing a specialty, until a sufficient number of stock plants can be grown to supply spores for home demand. Spores will do about equally well in pots or pans. Pans 12 inches square and 4 inches deep are used for that purpose, as also are the 6-inch common flower-pots. The 12-inch pans should be supplied with 1½ inches and the 6-inch pots with 3 inches of coal cinders for drainage. Soil for sowing spores on is best composed of five parts, in the proportions of two parts good garden soil, two parts of finely screened peat and one of sharp clean propagating sand. Leaf-mold may be used instead of peat, if easier to procure. This soil should be thoroughly sterilized, as already directed. The spore-pots should be filled with the soil to within ¼ inch of the top; press firmly. The rest of the pots should be filled with the same composition after it has been passed through a screen of about ⅛-inch mesh, then made absolutely level, firmly pressed and thoroughly watered with sterilized water. Three or four hours after watering will be the best time to sow spores. The spores should be thinly scattered over the surface of the soil, a quantity that can be held on a surface of ¼ square inch being abundant to sow one 12-inch pan. Spores should not be covered with soil. Immediately after sowing, the sash of the propagating-frame should be tightly closed and kept so until spores show signs of germination, when a small quantity of air should be given and gradually increased, so that by the time the first small fronds have made their appearance they may have been sufficiently hardened off to have the sash removed entirely. In sowing spores, great care will be necessary to prevent them from getting mixed, fern-spores being very minute and so light that the slightest movement of air will carry them long distances. While sowing spores, all spore-pots should be kept tightly covered. Being kept in a very close and humid atmosphere after sowing, the spores should not require any watering for one or two weeks, by which time they will have sufficiently settled not to be dislodged by a very gentle overhead watering, which should be given whenever soil shows the least sign of being dry. Sterilized water should be used until after the first delicate fronds have been formed. As soon as the first little fronds have made their appearance, care should be taken to weed out all undesirable varieties, which, even with the very best of care, will occasionally creep in. A temperature of 65° F. should be maintained in the propagating-house.

1488. A fern pan.

As soon as the first small fronds are evenly formed all over the surface of the pot, the little plants should be transferred in clumps of four or five plants each, to well-drained pans (Fig. 1488) or boxes filled with soil composed of one-half rich garden soil and one-half peat or leaf-mold, finely screened. In transplanting, great care should be exercised not to cover the remaining prothalli, but to have them just level with the surface of the soil. The clumps of plants should be kept as loose as possible, as this will give each individual plantlet a better chance to form the necessary number of rootlets, and it will, later on, also be easier to separate the plants. Boxes for transplanting ferns are most convenient when 4 inches deep, 14 inches wide and 22 inches long. These boxes will hold about 200 plants placed about 1 inch apart. As soon as the little plants have formed two or three fronds each, they should be separated and transplanted singly into boxes similarly prepared as before, where they may remain until sufficiently strong to be potted into 2- or 2¼-inch pots.

Times of sowing fern-spores are the first weeks of March, July and October. When making three sowings a year, and allowing a sufficiently longer time for slower-growing varieties, a constant supply of plants will be assured. In calculating on time of sowing spores of commercial varieties of ferns, it will be helpful to divide them into two classes, as some varieties are considerably slower of growth and will consequently have to be sown earlier, in order to be ready for sale at the same time as the more rapid-growing ones. The following popular commercial kinds will require from nine to ten months between times of sowing and potting. The names are those that the plants bear in the trade:

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Adiantum cuneatum.
" " variegatum.
" " grandiceps.
" Bausei.
" decorum.
" Fergusonii.
" gracillimum.
" mundulum.
" tenerum.
" Wiegandii.
Cibotium Schiedii.
" regale.
Cyathea medullaris.
Cyrtomium caryotoideum.
" Fortunei.
" falcatum.
Davallia tenuifolia stricta.
" " Veitchiana.
Dicksonia antarctica.
Doodia aspera.
Doodia aspera multifida.
Doodia caudata.
Doryopteris nobilis.
Lastrea aristata.
" " variegata.
" chrysoloba.
" opaca.
" Sieboldii.
Lygodium japonicum.
" scandens.
Nephrodium hirtipes.
Nephrolepis exaltata.
" cordata compacta.
Platyloma Bridgesii.
" falcata.
Polypodium aureum.
" fraxinifolium, etc.
Polystichum coriaceum.
" setosum.
Pteris Victoriæ.
" tremula Smithiana.

The following trade ferns will develop into plants large enough to be potted in about six months after sowing spores:

Adiantum pubescens.
" hispidulum.
Alsophila australis.
Gymnogramma calomelanos.
" chrysophylla.
" decomposita.
" peruviana.
" sulphurea.
Lomaria ciliata.
" gibba.
" " platyptera.
Nephrodium immersum cristatum.
Nephrodium molle corymbiferum.
Onychium japonicum.
Pteris argyræa.
Pteris cretica albo-lineata.
" " magnifica.
" " Mayii.
" " nobilis.
" hastata.
" " adiantoides.
" internata.
" Sieboldii.
" leptophylla.
" Ouvrardii.
" palmata.
" serrulata.
" " cristata.
" " " nana.
" tremula.
" Wimsettii.

It should also be borne in mind, when calculating time of sowing, that spores sown in the autumn will require about four weeks longer for development than those sown at other times of the year.

Fern-spores are borne on the back or under side of fronds. In some cases they are borne naked on under surface of frond, while in others they are produced under a scale-like membrane or indusium. In some cases, as in Pteris, the edge of the pinnæ is folded back over the spores, while in adiantums a small part of the leaflet is folded back over each little fruit-dot to serve as a shield or indusium. Davallias form a small sack-like receptacle at the extremity of the pinnæ. The proper time of gathering spores is when they assume a light brown, rather dry appearance, or in the indusium-bearing kinds when the indusium or shield begins to open. Spores should be gathered on a dark day when the fronds are slightly moist, as they will be better retained in that condition, and will not be so liable to get mixed when disturbed. Fronds, or parts of them, should be cut off entirely in most cases, put up in tight paper bags and stored on shelves in a dry closet for a week, by which time, in most cases, they will be sufficiently dry to have spores removed from them by rubbing the frond in a sieve which has about twenty meshes to the inch. When thus separated from fronds, the spores should be put up in small seed-bags and placed in air-tight jars until required for sowing. Cared for in this manner, perfect success has been invariably secured, even after keeping spores for years.

Propagation by other means.

Some ferns form little plants at the ends of pinnæ and of fronds, which upon attaining to sufficient size may be detached from parent plants, planted into shallow, well-drained seed-pans, and for a week or two left in the propagating-frame, where they will soon form roots, when they can be potted. Among such are *Adiantum caudatum*, *A. Edgeworthii*, *A. lunulatum* var. *dolabriforme*, *Asplenium Belangerii*, *A. bulbiferum*, *A. salicifolium*, *Polystichum angulare* var. *proliferum*, and many more.

A very useful decorative fern is *Nephrolepis davallioides* var. *furcans*, and it will make a beautiful specimen plant in a comparatively short time. To grow large quantities, the old plants should be cut back to within 6 inches of surface of soil and placed in a house where a bottom heat of 90° F. may be secured, when they will soon form a large number of short, strong fronds. At this time they may be divided into a number of small plants, potted off and placed in the same position as the parent plants. A somewhat slower method is to plant out a number of plants on a bench into 5 inches of soil, in which soil the rhizomes, running over the surface, will form a number of small plants, which may be detached and grown on.

A beautiful fern is *Adiantum Farleyense*, and it deservedly ranks as the greatest favorite among fern-lovers. It is best propagated by division. From old plants, cut off all fronds down to the rhizomes, wash off soil, cut rhizomes into pieces ½ inch long, insert same into well-drained fern-boxes about ½ inch apart, in 1½ inches of clean, sharp propagating sand. Place same in propagating-frame in a temperature of 70° F. In this position each little fragment of rhizome will form two or three little fronds in about fifteen or twenty days, when they may be potted off singly into 2-inch pots and kept in a temperature of 70° F. The soil best adapted to *A. Farleyense* is finely chopped sod which has been piled for about six months, with one-fifth well-decomposed cow-manure added. To attain perfection in growth and coloring, *A. Farleyense* should be kept in a light, airy and sunny house, in which every condition of moisture and atmosphere can be kept under absolute control. In a house of this kind, the greatly admired and beautifully pinkish tint may be easily obtained and fronds will be hardy and of good substance. A temperature of 70° F. is at all times desirable.

General culture.

To grow ferns such as are used for jardinières and decorative work and mentioned in the two preceding lists, a temperature of no less than 55° F. should be maintained at all times at night in coldest weather, with a rise of temperature in the daytime of 10° or 15°. To keep ferns in a healthy and growing condition, to prevent and to kill insect pests and diseases, a proper condition of atmosphere should be carefully maintained at all times. Extremes in heat, moisture or dryness should never be allowed. On a warm, dry, sunny day, when a great deal of air has to be admitted, much of the moisture of the house is consequently carried off; it will be of great benefit then to syringe the ferns once or twice a day, also occasionally to dampen floor of houses. An excessively dry atmosphere induces the development of the very troublesome pests, thrips and red spider. On damp and rainy days a saturated atmosphere should be prevented by supplying a little artificial heat, even if some air has to be admitted at the same time. This slight expense of heating on damp days will abundantly pay for itself by causing the growth of strong, thrifty plants. An excessively moist atmosphere causes parts of fronds of a great many plants to turn black and to rot off, besides inducing the development of almost incurable fungoid diseases.

The soil for deep-rooting ferns should be as follows: Three parts fibry loam, one part fibry peat, one part leaf-mold, one part sand, one part sphagnum moss, one-half part broken crocks and one-half part broken charcoal. These ingredients should be thoroughly mixed and ample drainage provided. For shallow-rooting ferns the following compost should be used: One part fibry loam, one part peat, one part leaf-mold, one part sphagnum moss, one-half part broken crock, one part sand, one-half part broken charcoal. If the charcoal cannot be readily secured, half the amount of sand and finely broken crocks will answer,

although the composition as prescribed is preferred, as charcoal keeps the soil sweet and may spare time for repotting.

In potting ferns after they pass 4-inch pots, a potting-stick should always be used as the potter cannot very well firm them with his fingers, and it secures eveness in potting. Ferns should be potted tight, especially old plants. Also old plants should be partly shaken out and the roots shortened somewhat, and if carefully handled will quickly reëstablish themselves and make better plants. A potting-stick is very handy also for pressing the compost between rhizomes, and it can be done much more neatly than with the hand.

In the selection and growing of stock plants, the careful grower should always be on the watch for types which are most perfect in shape, in character of individual fronds, in coloring, freedom of producing spores, and exemption from the attacks of insects and fungous diseases. In a large number of ferns a great difference between the different plants of the same species will be apparent to the careful observer. Some plants of same species have beautifully developed fronds, but are carried on long, weak stems, which makes them unfit for general use. Others may be of compact, sturdy habit of growth, but with poorly shaped individual fronds. In some individuals the coloring will be greatly superior. By closely studying all these points and by continually selecting only the most perfect types of ferns from the young plants, one can in a few years work up a very desirable and superior stock. The same stock plants of the rapid-growing varieties of ferns should not be carried over for more than three or four years, but young and more desirable plants should continually be selected and grown to take their places.

1489. Cyrtomium falcatum. Young plant.

The stock should be shifted into larger pots whenever necessary, and placed in a light, airy house, in which all necessary conditions are under perfect control, and in which a temperature in coldest weather of 55° F. at night, with a rise of 10° or 15° in daytime, can always be maintained. The house should be shaded just enough to prevent fronds from turning yellow. Proper attention to atmospheric conditions of stockhouse should never be neglected. Stock plants should not be permitted to remain pot-bound for too long a period of time, except with a few kinds, such as alsophilas, dicksonias, cyatheas, cibotiums, *Pteris tremula*, *P. argyræa*, some davallias, and *Polystichum coriaceum*, which, if given too much nourishment, will often be very slow in setting spores.

Insects which are most troublesome to ferns are thrips, red spider, scale and mealy-bug. They are mainly present in a too-dry atmosphere. Thrips, red spider and mealy-bug are easily prevented by a properly moistened atmosphere, also by spraying of foliage once a week with tobacco water. As tobacco greatly varies in strength, every grower will have to determine to his own satisfaction how strong to make his solution. The preparation known as "Rose-leaf tobacco extract," has proved very efficient in destroying these insect pests. To fifty gallons of water add one quart of the extract, and apply with some good insecticide sprayer and a force pump. Fifty gallons of this solution will be enough to spray 100,000 ferns in 2¼-inch pots.

Bearing in mind the foregoing advice, the amateur fern-grower may determine the proper way in which to raise his plants. He may not have a fern-house, but he can have a tight glass box or Wardian case. The bottom should be a zinc tray, to prevent drip on the floor and to prevent too rapid drying out of the soil. The top or roof of the box should be hinged, so that it can be raised. In this miniature greenhouse many interesting ferns can be grown. Lycopodiums and selaginellas (which see) are treated in much the same way as ferns.

NICHOL N. BRUCKNER.
X. E. E. SCHMITT.†

List of tender ferns. (X. E. E. Schmitt.)

Acrostichum. A widely distributed class of ferns found in tropics of both hemispheres; some have fronds that are solitary, while others are pinnatifid; some are deep-rooting and require a loamier soil, while others are shallow-rooting and require a very shallow and porous soil. They are a class varied in many respects; the fertile fronds are totally covered on the under side with the spores, generally brown in color, and when ripe, after shedding the spores, will perish and be succeeded by the barren fronds. Propagated by division and spores. Winter 55° to 60° night. They should have a perfect drainage, the deep-rooting ones of ordinary depth, but the shallow-rooting are best grown in a depth of about 2 inches of soil and very porous, as for davallias, the shallow-rooting species; they all love a moist and shady atmosphere except *A. aureum*, which will stand sun with its roots in 2 inches of water; it is found in Florida and tropical America.

Actinopteris. A low-growing and charming class of ferns with palm-like or rayed fronds. They thrive best in a compost of loam, peat, chopped sphagnum moss, coarse sand and crocks (broken small), in equal parts; they should have ample drainage, filling the pots about half-full with crocks. They require a good light and plenty of moisture; they are best propagated by spores; they can also be divided. Winter temperature, 58° to 60°.

Adiantum. The maidenhair ferns with fronds, the individual pinnæ of which vary from not more than ⅛ inch in width in *A. gracillimum* to the large *A. peruvianum* with pinnæ 2½ to 3 inches long. They are hardy, stove and temperate ferns, and require a deep rich soil and plenty of water during the growing season, and less during the resting-period, which is usually from December to the latter part of February. They should be allowed to get fairly dry but not wilted before they are watered again. In most species or varieties of garden origin, remove part of the old fronds just as growth commences; with some of the denser-growing sorts, all the fronds may be cut away just as the new growth is commencing, as it is very tedious and there is not much gained thereby. It should be cut close, but with sparser or large-growing sorts as *A. trapeziforme* and many other strong-foliaged sorts, it is better to leave all the good foliage possible to stimulate the new growth; turn the plants out of the pot, cut away the lower half of the ball and trim in the sides of the old ball close to the rhizomes with a large knife, then loosen slightly the edge of the ball with a sharp-pointed stick so that the roots will feel the effect of the new move readily; never round off the sides in a slant or sloping manner as the old crowns are very closely knit together and trouble would be experienced in getting them wet through again. Should they become too dry, give a little water every few minutes until they are given enough to penetrate the old ball. The crowns should be let down a little deeper than they were when turned out of the pot. The surface should be slightly pointed here and there which will help the water more readily to penetrate. Have the pots well drained, placing a thin layer of sphagnum moss over the crocks which will keep the drainage clean. Fill in the soil, pack firmly with a potting stick up to the height required to receive the ball, which should be low enough to give a light covering of soil; they throw out their new roots from top, bottom and sides; then place in a layer of soil, tightening it with the potting stick, place layer after tightening as before until it has reached the required height; give a fair watering, fill about twice the space left from the top of the soil to the rim of the pot. They will not require any water for two or three days, then give a light sprinkling with a watering-pot with a rose on. They will require to be looked over every other day or so. In about a week's time they will require a moderate watering, but not so heavy as at first. After potting, an increase of 8° to 10° in temperature, both by night and by day, is necessary. Some of the smaller-growing sorts will require a deeper drainage and smaller pots. Adiantums with a few exceptions will not tolerate syringing at any time, particularly during dull or cloudy weather, as damp may settle in the foliage and ruin several plants, but care must be taken that they have sufficient water at the roots, as in the growing season they take a good supply of water. The temperature in winter for greenhouse ferns should be 52° by night, adding 6° to 8° by day; stove should be 56° to 58° by night, adding about 6° by day. Adiantums require a mixture of chopped or hand-broken fibry sod that has been stacked about six months, one-half part peat, one-half part leaf-mold, one part well-decayed cow-manure preferred (as they are good feeders), one and one-half part sand, one part chopped sphagnum, one-half part broken crocks and one-half broken charcoal about ¼ inch in size, using fine and all; place in

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even layers in the order above stated, then turn three or four times which will leave the whole evenly mixed, when it will be ready for use. For cult. of *A. Farleyense*, see p. 1212.

Alsophila. Tree ferns, natives of tropical America and Australia. *A. australis* and *A. excelsa* will stand sun with a copious supply of water. Soil as for Dicksonia. Winter temperature for Australian species, 50° to 55°; for West Indian, 58° to 60° night.

Anemia. A pretty class of small-growing ferns, sometimes called the flowering ferns, as the fertile sprays appear along with the sterile frond. They require an open porous soil and are not deep-rooted. Moderate temperature, 52° to 55° winter temperature by night. Propagated by spores.

Angiopteris. Giant ferns, more resembling a cycad than a fern, were it not for the spore cases. They are native of tropical Africa, tropical Asia and the Philippines. They are deep-rooting, with heavy and fleshy roots, and enjoy a rich deep and porous soil. They require a high and moist temperature, not less than 60° by night in winter and will stand 90° or more in summer. They require shade during summer, with more light during winter. A soil as for dicksonias, with the addition of a little manure is satisfactory. They should be potted just as growth is commencing. Care should be taken not to bruise their fleshy roots; should any be damaged they should be cut off with a sharp knife. Propagated by spores and division, both a slow process, but more readily by the large and fleshy scales carefully removed from the old plants, laid between sphagnum moss, sand and broken crocks in a case with a bottom heat of 80° or a little more; they should be laid on a slant with inner side of scale facing upward. When they have formed buds, emitted roots, and made two or three leaves, they may be detached and potted singly in as small pots as their roots will permit; return to case and inure to more light and air gradually; each scale may bring four or five plants.

Blechnum. Ferns of easy culture, requiring moderate shade. Allied to Lomaria. Several of them are dwarf tree ferns; others have spreading rootstock. They will not stand dryness; require a moderately strong soil containing a small amount of manure.

Cheilanthes. A class of dainty and graceful ferns. They require an open and porous soil; will not tolerate syringing, and require a good light at all times. Propagated by spores and division, spores preferred. They will not stand an overabundance of moisture at any time, but will well repay proper care, as they are all very beautiful. Some have fronds resembling the palmate fronds of Doryopteris, while others are very much divided. The soil should consist of one part fibry loam, one part peat, one part leaf-mold, one part sand, one-half part broken crocks, one part sphagnum moss and one-half part broken charcoal, broken quite small, the whole thoroughly mixed together and the pots well drained. A temperature of 50° to 55° suits them best in winter.

Cyathea. Beautiful tree ferns, native of New Zealand and tropical America. *C. medullaris* will grow to a great height, from 60 to 75 feet, and is often seen in its wild state far above the surrounding vegetation. Will stand full sun. Temperature for New Zealand species, 50° to 55° winter; tropical American, 55° to 60° nights. Soil as for Dicksonia.

Cyrtomium. Fig. 1489. Ferns of easy culture. Require a greenhouse temperature of 48° to 50° by night in winter; will stand a strong light and partial shade. Useful for fern-dishes. Allied to Aspidium. General culture for ferns.

Davallia is a beautiful class of ferns found both in the tropical and subtropical zones. The smaller-growing forms can be grown in shallow baskets or pans and have a fair amount of rest in winter. The Japanese fern-balls are probably *D. bullata* and *D. Mariesii*, and can be laid out in the garden and frozen down to zero and when the growing season returns watered and they will begin to grow again. Davallias with heavy rhizomes or any of the surface creeping sorts will want to be kept a little on the dry side during the resting period, which is from the beginning of December to about March, when they will gradually recommence, and water should be given accordingly. They must be syringed at least twice daily in winter, as black thrip is liable to attack them; should they be attacked, dip in a medium solution of aphine or fresh tobacco water. Should the plants be too large to handle, syringe them with aphine or tobacco water at night and give a thorough syringing with clear water the next day; apply two or three times, then stop for two or three days, then repeat, after which the troubles will be over. The cooler kinds will commence their growth about a month later than stove kinds. They should be repotted or top-dressed just as growth commences, if they require it.

D. pallida is a fern which rests from December to March, at which time gradual increase of water may be given it and by the end of March it will be commencing its growth. It should be carefully separated, taking care not to injure the points of the rhizomes. Many of them will be found all the way to the bottom of the pots or pans in which they have been growing. It is well to leave an old specimen undisturbed for three or four years and only give a light top-dressing in the spring as growth is commencing, and weak liquid manure about every two weeks as the fronds are unfolding; but always water with clear water first, then follow with liquid manure. It requires a stove temperature of 58° to 68° by night, adding 6° to 8° by day on bright days, during its resting period, with corresponding increase during the growing season of about 20°. It needs a good strong light but also shade. It requires a good supply of water during its growing season and only a small amount once a week, but must be syringed twice daily. The composition of the soil should be an open and porous material consisting of the following: two parts fibry loam which had been stacked about six months and broken up by hand (not sifted or pulverized), one part fibry chopped peat, one part leaf-mold, one part sand, one-half part broken charcoal, using in the same manner as the crocks, one part sphagnum moss chopped roughly, all the parts of this composition placed in even layers in the order named four times, first to the left, then to the right, when it will be of the proper texture ready for use. The pots or pans should be well drained by placing a flat piece of crock over the holes flat side down. The soil should be hand-picked so as to be free of worms and insects. This process is slow and tedious, but when there is taken into consideration the length of time a plant is to remain undisturbed, too much care cannot be taken. Place the curved pieces one against the other until the entire bottom is covered, then place a good sprinkling of clean ¼ inch soil (no dust), and cover the whole with a thin layer of sphagnum moss, covering the crocks evenly so that no soil will pass through. The receptacle is now ready for the soil. Place some of the roughest of the soil directly over the moss, then filling up to within 2 inches of the top, pack down evenly with a wide potting stick so that they will not sink afterward; now put in the rhizomes one by one, setting the points so that they will be evenly distributed, and firm the soil tightly with the fingers, as a potting stick cannot well be used on account of bruising; let them be about even with the top on the sides and slightly rounded in the center; stake the fronds with light stakes to keep them steady, which will give them a neat appearance as they will have to remain until the new growth has developed and the plant is reëstablished with new roots, when they will sustain themselves without any supports. The plant is now ready for watering: one even watering is all that will be required and a light syringing four times a day. Should the surface become dryish a light watering should be given as when first potted, but after this the plants will require water more frequently as they will be making roots rapidly as will be indicated by the foliage that has developed. Directly after potting keep the house close and increase the air gradually until full air can be given. Hard-leaved ferns like davallias can stand a light syringing three or four times a day on all bright days but none on cloudy days unless there is artificial heat on. Decrease syringing as the cool nights of the end of summer and autumn approach; the temperature may also be lowered until it falls to the winter temperature with the declining season. The foregoing soil is suitable for most shallow-rooting ferns.

Dennstædtia. With creeping rootstock. Winter temperature, 52° to 55°. Propagated by spores and division. Culture as for Microlepia.

Deparia. A small group of ferns with arching fronds. Stove winter temperature, 55° to 58°. Propagated by spores or bulbils that form on the fronds. Culture, see main article (p. 1210).

Dicksonia. An interesting class of tree ferns from Australia. They require a cool temperature and partial shade in summer, but their stems must be syringed frequently. They must never be allowed to dry at the roots, and even more copiously watered in summer. Winter temperature, 45° to 48°; can be stood outside in summer. Can be propagated by spores or side growths carefully removed from the parent stem without injuring the heel. Require a soil of three parts loam, one part peat, one part leaf-mold, a little more than one part sand, some broken crocks and sphagnum moss with the whole, and well drained.

Didymochlæna. An interesting group of ferns of distinct habit and growth. Winter temperature, 55° to 58°.

Diplazium. A rather coarse-growing but interesting class of ferns, grown mostly in the greenhouse. Allied to Asplenium. A fairly porous soil suits them best. Propagated by spores or division. Winter temperature, 55° to 60.°

Doodia. A small and distinct class of ferns of cool temperature, 48° to 52°. Propagated by spores and division. For culture, see main article (p. 1210).

Drynaria. Plants with a thick and downy rhizome. Propagated by spores and division. All stove ferns allied to Polypodium.

Dryopteris. Small stove ferns. Require a winter night temperature of 55° to 58°.

Gleichenia. A genus of most beautiful and graceful ferns, natives of Australia, New Holland and tropical America. They thrive best in a compost of one part loam, one part peat, one-half part sand, one-half part broken crocks, one part sphagnum moss; in potting, the center of the plant should be dropped a little below the rim of the pot so that the outer rhizomes can rest on the new soil, leaving the center a little deeper than the outer edge; pin the rhizomes down carefully but do not cover; pot firmly; give a gentle watering; syringe several times a day, but take care not to overwater. They love a cool, moist atmosphere; the tropical American ones can stand a little more heat, also a little sun; winter temperature for New Holland ones, 48° to 52°; American, 50° to 55°. Care should be taken at all times not to overwater or let them get too dry; the best way is to sound them with your knuckles, and in fact almost any plant of careful treatment should be treated the same way.

Goniophlebium. Mostly a deep and free-rooting class of ferns, demanding culture as for Polypodium.

Hemionitis. An interesting class of low-growing stove ferns requiring a porous soil. Winter temperature, 55° to 58°. Propagated by spores, or by pinning a mature frond having formed buds, on a surface of porous sandy material, which readily form new plants.

Hemitelia. A distinct and striking class of tree ferns, native of tropical America and the Philippines. They are all stove ferns requiring 60° winter night temperature and ample moisture and shade at all times; soil as for Dicksonia, as they are heavy and deep-rooting.

Hymenophyllum. A class of ferns of most graceful and delicate structure; native of tropical America. They require a deep shade and a shallow compost to grow in as they are found growing on tree ferns and sandstone; the following will suit them best: sandy, lumpy peat with very small pieces of sandstone and live sphagnum

moss, carefully placed between the small rhizomes and grown in a dense shade. Their foliage should never be allowed to become dry; they should be grown in a case. Winter temperature, 52° to 55°.

Hypolepis. A class of ferns with creeping rootstock, of easy culture, requiring shade. Propagated by spores and division. General culture of ferns.

Leucostegia. A class of ferns allied to Microlepia and Davallia, which see. Deep-rooting ferns of easy culture. Winter temperature, 52° to 55°.

Lygodium. A class of ferns of easy culture, requiring a deep rich loamy soil. *L. palmatum* is hardy. For culture, see main article (p. 1210).

Marattia. A bold, distinct, and interesting class of ferns. Allied to Angiopteris, which see for treatment.

Meniscium. A small class of interesting low-growing ferns. Require a medium temperature of 52° to 55° in winter. General culture of ferns (p. 1210). Propagated by spores.

Microlepia. A class of mostly strong-growing and graceful ferns of easy culture; *M. hirta* var. *cristata*, being crested, makes a beautiful specimen. They like a strong open soil with a little cow-manure added and a fair supply of water at all times. They require good light but shady. Propagated by division or spores.

1490. Pteris cretica var. albo-lineata. (× ½)

Nephrolepis. A large group of ferns having more garden forms than any other class of ferns, and the end is not yet in sight, as every year or two another form appears; the type *N. exaltata* will grow fronds 4 to 5 feet long, while some of the variations will grow them as short as 8 inches long. All the forms of *N. exaltata* will stand sunshine under glass. A compost of three parts good fibry loam, one part manure, one part sand, a small sprinkling of leaf-mold and sphagnum moss thoroughly mixed, suits them best. They like a fair supply of water at all times. When potting, always drop the plant down so as to cover ¼ inch, as the young fronds will readily push through the soil. *N. Bausei* is deciduous. *N. Duffii* is a small fronded and beautiful species. Propagated readily by runners, of which they furnish an abundance; pin the runners down over the surface of the soil; in a short time they will make a lot of young plants which can be taken up when they have made two fronds, potted up into 2-inch pots, kept close for about two weeks, when more air can be given them; then pot on as required.

Notholæna sinuata. Native of Mexico; an interesting and graceful fern of downy foliage. Grows well in a medium temperature. Care must be taken in watering; it will not stand syringing. An open porous soil suits it best. Propagated by division or spores, spores preferred.

Onychium. A class of interesting and graceful ferns of easy culture for which see main article. Winter temperature 48° to 52°. Propagated by spores or division.

Pellæa. A very interesting class of low-growing ferns of neat and graceful habit. Winter temperature 55° to 58° at night. Requires a porous soil and good light; will not stand very much moisture on foliage. Thrip and mealy-bug are the worst enemies. Readily propagated by spores or division.

Phlebodium. Ferns of strong-growing habit. See *Polypodium.*

Phyllitis. A class of shallow-rooting ferns of easy culture. Allied to Polypodium, which see.

Phymatodes. Somewhat shallow-rooted, but fairly strong-growing ferns, of easy culture. Best grown in pans. Require partial shade and a porous soil as for shallow polypodiums or davallias. They may also be used to cover walls in greenhouses, and to grow on trunks of tall tree ferns.

Platycerium. The stag and elk's-horn ferns. A distinct and most interesting class of ferns. They naturally grow in the forks of trees and on rocks. They are best grown on blocks or rafts; fibry peat and live sphagnum moss suit them best. They should have plenty of water in the growing season and a moist atmosphere at all times. Winter temperature at night, 58° to 60°, adding 5° to 7° by day.

Polypodium. Comprising many divisions and many of them in common cultivation. They are native of all climes. Some are hardy with hardly any protection, while some require stove temperature. Some are deep-rooting, while others are very shallow-rooting and require a very porous soil. They are mostly evergreen excepting the hardy species, which are deciduous. Some of the shallow-rooting species will grow on a surface of very shallow material composed of peat and moss, while others require an addition of loam. They are varied and distinct and can be employed for many purposes, to cover walls in a greenhouse or conservatory or rockwork out-of-doors. Some are very decorative and bold in habit, while others are graceful and beautiful. The deep-rooting kinds require a compost of two parts loam, one part leaf-mold, one part peat, one part sand, one part sphagnum moss, one-half part broken crocks and one-half part broken charcoal; they require ample drainage and an ample supply of water when growing, and reduced amount when at rest in winter. The shallow-growing sorts will require ample drainage and a compost of one part fibry loam, one part peat, one part sphagnum moss, one-half part broken crocks and one-half part charcoal. Some of the sorts will grow on a mossy surface or can be employed to cover walls or unsightly places in a greenhouse and by receiving an occasional syringing will do well, while others are better grown in pots or pans. Pans for many are preferred.

Polystichum. Many of these are hardy or will winter out-of-doors with moderate protection. Propagated by spores or by pinning down the fronds on a porous surface until small buds are fairly well rooted, when they may be detached and potted singly. A moderate soil suits them best.

Pteris. Fig. 1490. A various group, some of them hardy, others suitable for greenhouses and for stoves. They are not particular as to soil; a mixture of two parts peat, one part loam and one part sand will suit them. The variegated forms should be protected from very strong light. Some of the species propagate readily by division of the creeping rhizomes. Most of the tender species thrive in an intermediate or greenhouse temperature.

Selaginella. A class of plants of decorative and useful character and varied in form of growth as *S. cæsia, S. arborea* and *S. Willdenovii;* will grow to 15 or more feet, while others will not rise over 2 inches or so. Propagated by cuttings in the larger-growing kinds, division in most kinds, and pegging in some tall-growing species. Take down a tall-growing sort and peg it to mossy and sandy surface and in a short time when fairly well rooted, it may be potted separately in the regular mixture for Selaginella. Compost for Selaginella, two parts loam, one part fibry peat, one part leaf-mold, one part sand, one part sphagnum moss, one-half part broken crocks and one part charcoal. Mix the whole thoroughly, drain well as recommended for ferns. *S. grandis* and *S. Lyallii* require a Wardian case and will need a very moist atmosphere at all times, also a temperature of 60° by night, with corresponding increase by day in winter; in summer, 80° to 90° by day.

Todea. The filmy ferns of New Zealand are *T. superba*, the finest of them all; they are rare and seldom met with; they love a deep shade and coolness at all times; a temperature of 40° to 45° in winter suits them best. Their fronds should never be allowed to become dry. The strong-fronded ferns are stove ferns, requiring a winter temperature of 55° to 60°.

Trichomanes. A class of filmy ferns of great beauty, requiring a cool and moist atmosphere. They should be grown in fibry peat, sphagnum moss, sand, and broken crocks in equal parts. They are very shallow-rooting and must be handled with the utmost care in repotting. They must be potted tight, and if small broken sandstone can be had, all the better; the depth of the soil need not be more than 1 to 1½ inches. Temperature 45° to 50° in winter. They should be grown in a Wardian case, kept close except an opening on the coolest side. The fronds should never become dry; but should be sprayed several times a day if there is danger of their becoming dry.

Vittaria lineata. A very unusual fern growing naturally on trees in southern Florida. It does best fastened on a block in a mixture of fibry peat and sphagnum moss or in shallow baskets in the foregoing materials with a portion of sand, broken crocks and charcoal broken small. Pot firmly but let the material be shallow. It loves plenty of water at all times and a good light. Propagated by division and spores. Winter temperature 55° by night.

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Cultivation of hardy ferns.

The hardy ferns are easy to transplant and tenacious of life under adverse conditions, but since the beauty of fern foliage is brought out only by luxuriance of growth, it should be the aim to plant only where such can be secured.

Ferns in general require positions in which the soil retains an even amount of moisture at all times. Most species do not grow well in a cultivated border or where the space between the plants is not mulched or given a ground cover of mosses or other plants which hold the temperature and moisture of the soil surface more evenly and allow the ferns to grow roots near and on the surface of the ground. Also when the earth is bare between the plants, the rains dash mud on the under side of the fronds—a condition under which no fern can thrive. However, some of the stronger-growing species, as the osmundas, because of their height and strong deep roots will do well in a cultivated border. A study of the soil surface where the fern is growing well in the wild will show about what is necessary.

Some ferns, as the maidenhair (Adiantum), have strong wiry stems which will push up through a very heavy covering of leaves, while other species, as all of the evergreen ferns, grow in positions in which the annual fall of leaves does not remain on their fronds. The larger number of ferns prefer no heavier mulch than is made by the death of their own fronds, which naturally fall away from the center of the plant, mulch the surrounding soil but leave the crown of the plant uncovered and unhindered for its growth in the spring. Many of the smaller ferns which have neither deep nor strong creeping roots require a ground cover of other plants or simulated conditions to prevent their being heaved out of the ground during the winter. A number of species with strong creeping roots as *Dennstædtia punctilobula* (*Dicksonia pilosiuscula*) and *Dryopteris* (*Aspidium*) *novaboracensis* eventually form thick masses which completely cover and fill the ground with roots. When this condition has been attained, no soil mulch or cover is needed, and even the old fronds had best be removed before growth starts in the spring.

Ferns may be separated into two classes by their stems: (1) those with creeping stems; and (2) those having a central crown or cluster of crowns.

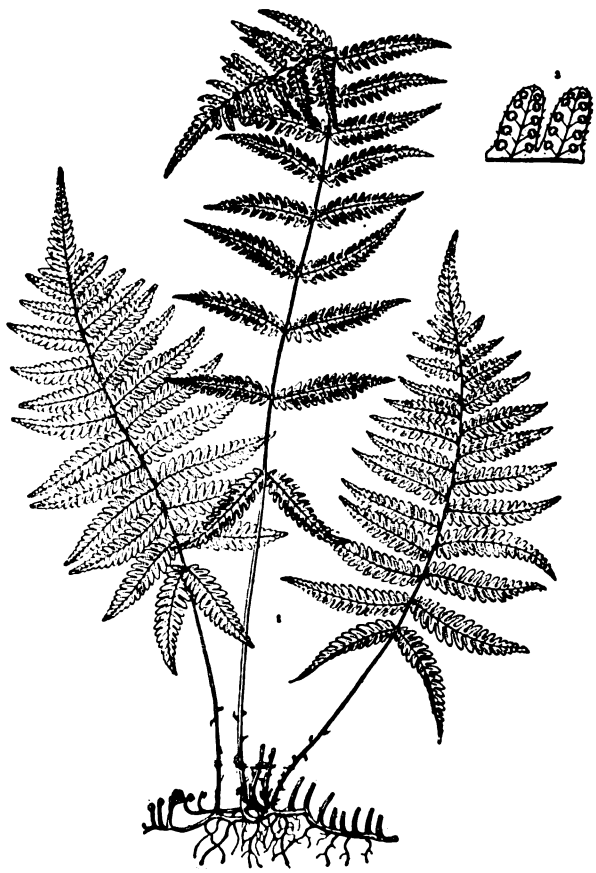
Those with creeping stems spread and form large masses. They not only send up a crop of fronds in the spring but continue to grow new fronds during the season. This class of ferns may be transplanted at any season with ordinary care, in fact the fronds may be mowed off and the roots taken up in sods and relaid like turf, but better results will be secured with more care to preserve the younger and newly started fronds.

Those ferns with distinct crowns naturally send out only one set of fronds each year. This class of ferns is best moved after the plants have ceased growth in the fall or before growth starts in the spring. Especially is this the case with those species having deciduous or fragile fronds which easily become wilted or broken. When transplanting while in leaf, it is necessary to preserve fully half of the fronds to insure a good growth the following year. The evergreen species, as the Christmas fern (*Polystichum* or *Aspidium acrostichoides*), *Dryopteris* (*Aspidium*) *marginalis* and others with hard coriaceous foliage, can with reasonable care be transplanted at any season of the year.

In general, the soil for ferns should be rich in humus and mineral matter and sufficiently friable to allow penetration by the fine roots. A heavy clay is not satisfactory but may be corrected by the addition of a sandy soil and thoroughly rotted manure or leaves. A pure leaf-mold is not a good fern soil because it is lacking in minerals and is too light and loose for any fern except the Adiantum. A good sandy loam with too little clay to bake and not enough vegetable matter to be spongy will suit the larger part of ferns. It will be noticed that most species of ferns with crowns grow in the wild where their roots reach through the surface mold to a more mineral soil underneath; in fact they often grow in apparently poor yellow loam.

The following ferns grow luxuriantly in full sunlight with suitable conditions of soil and moisture: *Pteris aquilina*, *Onoclea sensibilis*, *Dennstædtia punctilobula* (*Dicksonia pilosiuscula*), *Dryopteris* (*Aspidium*) *novaboracensis*, and the osmundas.

Practically all the remaining species prefer more or less protection from the direct rays of the sun, but darkness or dense shadow is not required. Even the species which grow in deep, dense shade apparently need only the humid atmosphere found there, since



1491. Dryopteris simulata.

near waterfalls and springs they grow in the open. In mountainous regions in which the atmosphere is cool and not drying, many species grow in full sunlight which require more or less shade in drier climates. Among such might be mentioned *Asplenium Filix-fœmina*, *A. acrostichoides*, *Phegopteris hexagonoptera*, *D. polypodioides*, *Dryopteris* (*Aspidium*) *Thelypteris*, *D. cristata*, *Onoclea Struthiopteris*, *Woodwardia virginica*, and *W. angustifolia*.

There are about seventy-five native American species which can be grown in northern gardens, and also a good number of quite distinct varieties. There are hardy species in foreign countries so that a complete collection of hardy ferns would probably reach 150 species.

The following species not natives of the United States are hardy at Philadelphia: *Dryopteris chrysoloba*, *D.*

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XLI. A good fern in southern California.—Alsophila australis.

dilatata, *D. Filix-mas*, *D. pseudo-mas Pinderi*, *Nephrodium hirtipes*, *Polystichum Braunii*, *P. lobatum* and *P. setosum*.

The following notes are drawn from experience in cultivation of these native ferns in the neighborhood of Philadelphia.

Adiantum pedatum prefers light, loose, rich soil in cool, moist shade, with yearly mulch of leaves. Soil conditions are more important than shade. Where established in a wild state will endure the full sunshine coming with the removal of trees until soil conditions change or it is crowded out by stronger plants.

Adiantum Capillus-Veneris. Soil conditions about the same. See that leaf-covering is not of too large and heavy leaves.

Asplenium acrostichoides. Culture as A. Filix-fœmina.

Asplenium angustifolium thrives on rich rather moist soil in shade. Avoid complete removal of fronds when planting in early fall, as this fern quickly sends up new fronds to the weakening of the following season's growth.

Asplenium Bradleyi. A small rare fern. See Camptosorus and A. pinnatifidum for cultivation.

Asplenium ebenoides. Culture same as for A. pinnatifidum or Camptosorus.

Asplenium Filix-fœmina. Give good rich loam, moist, with drainage, with some shade. Endures full sunlight in cool climate. A beautiful and extremely variable fern. A number of forms are catalogued.

Asplenium montanum. Cultivated as Camptosorus or A. pinnatifidum.

Asplenium pinnatifidum. A small evergreen fern found in the wild in cool shaded places in which there is an uniform amount of moisture in the soil and when the air is not given to quick extremes of temperature and humidity. Ferns of this character need about the same careful placing as do real alpine plants. Planting between stones is advisable. No winter cover, no bare soil and no plant stronger-rooted than a moss near it.

Asplenium platyneuron prefers partial shade. Care must be taken to prevent smothering by leaves, and to plant where the least likely to be heaved by frost. It is found most plentifully as a native on banks growing with grass and other plants in partial shade. The fronds are evergreen, but become discolored in severe weather. Any good loam suits it. Easy to move at any season but difficult to maintain in masses.

Asplenium resiliens (A. parvulum). Culture of A. platyneuron, *Asplenium Ruta-muraria*. Culture same as A. pinnatifidum.

Asplenium Trichomanes. A small fern growing well where A. platyneuron does. The shade of a small rock will suit it.

Asplenium viride. See A. pinnatifidum for culture.

Camptosorus rhizophyllus. WALKING-LEAF FERN. In wild state is found in cool, shaded positions not subject to excessive drought or moisture. It prefers a moist atmosphere but this is not necessary for good growth but where the best soil and atmospheric conditions prevail the leaves often attain a length of 18 inches before rooting. Avoid all winter covering.

Cheilanthes. Low-growing rock ferns generally doing well in fairly dry positions. *C. lanosa* prefers deep shade and more moist soil. *C. lanosa*, *C. tomentosa* and *C. Fendleri* at least of the species are perfectly hardy at Philadelphia.

Cryptogramma acrostichoides should have shade throughout year.

Cystopteris bulbifera. Will do well in usual deciduous shade in any loam, but grows best and produces far more numerous bulblets when planted on a moist bank of gravelly soil in the shade of kalmia.

Cystopteris fragilis should be planted in shade in positions where it will receive no covering of leaves. The fronds die in early August in the drier situations. It will grow in positions which become exceedingly dry in midsummer. It forces well in a coolhouse.

Dennstædtia punctilobula (Dicksonia pilosiuscula) prefers shady, moist situations where it does not receive any covering by falling leaves of large size. Grows well in sunshine. May be transplanted at any season, and takes kindly to heavy enrichment. The best fern to grow in quantity for cutting during the summer. Can be readily grown as a north border to a shrubbery in any medium to light loam.

Dryopteris Bootti is found in a wild state in moist, shaded positions, but will grow well in shade in quite dry positions. Does not need shade in winter. Use good loam.

Dryopteris cristata prefers moist to wet soil in shade. Will often burn with direct sunlight. Evergreen, quite variable. Var. *Clintoniana* is larger. The fern and variety appear to need swamp conditions to grow well.

Dryopteris Filix-mas. Practically the same conditions as for D. marginalis.

Dryopteris Goldieana prefers deep, moist, rich soil in cool shade. Grows finely in shaded places and soil suited to rhododendrons.

Dryopteris marginalis wants rich soil in rather deep shade during the entire year, but will grow well in partial shade—and endure even full sunlight, though not growing so luxuriantly. This is one of the native ferns commonly sold by collectors in city markets. It is evidently seldom established by purchasers of plants in full leaf. Once wilted the plants will not recover.

Dryopteris noveboracensis does best in rather moist, rich soil in partial shade, but will endure full sunlight with good soil conditions. Prefers light rich loam. One of the common field ferns growing in large masses either alone or with Dennstædtia punctilobula. When cut it wilts quickly so is of little value for bouquets. Easily transplanted at any season. Will not endure heavy mulch of leaves. Not evergreen.

Dryopteris spinulosa is less common in America than the var. *intermedia*, which occurs wherever conditions favor its growth. It has the finest cut or divided fronds of any of the large evergreen ferns, being almost the equal of the deciduous fern, Dehnstædtia punctilobula, in this respect. The fronds are gathered extensively for florists' use. In culture, give the same conditions as for Polystichum acrostichoides, with heavier shade and more moisture. The best fern to grow under coniferous trees.

Dryopteris simulata (Fig. 1491) is much like the following and requires similar conditions. It occurs in boggy woods from Maine to Maryland and perhaps westward.

Dryopteris Thelypteris prefers quite moist situations with at least partial shade. With congenial soil and moisture does well in sunlight. A distinct and pleasing deciduous fern.

Lygodium palmatum is rather difficult to establish. Give a deep rather moist light loam in partial shade.

Onoclea sensibilis prefers a rich, moist soil in partial shade or full sunshine. It will also grow in shade. It likes a heavier soil than most ferns and uniform moisture. Does poorly in dry soils.

Onoclea Struthiopteris should be given a rich, moist soil with at least partial shade. The fronds will "burn" in fierce sunlight. A good fern to grow north of a wall or building where specimen plants are desired.

Osmunda cinnamomea prefers moist, partially shaded situations, but will grow well in full sunshine in rich soil not exceedingly dry. Perhaps the most beautiful of the osmundas. Best to move while dormant.

Osmunda Claytoniana, a native of low ground, both in shade and sunshine, but will grow equally well in rich soil only fairly moist. Best transplanted when dormant.

Osmunda regalis prefers a peaty soil in very wet, boggy position in partial shade, but will grow as well in full sunshine if soil is rich and not dry. A very distinct fern.

Pellæa atropurpurea prefers rather dry positions in partial shade, winter and summer. It will not endure heavy mulching. Will grow in full sunshine, but not to its full size. It may be transplanted at any season.

Phegopteris Dryopteris prefers good soil in shade not over moist or dry. Avoid coating of leaves. It is a beautiful species and useful for planting on rockwork in shade. The fronds die in August.

Phegopteris hexagonoptera needs good soil in shade. Fronds die down rather early. Will not grow well through a leaf mulch.

Phegopteris polypodioides prefers moist, shaded positions, but will grow in any good soil not too dry. The fronds die down in late summer, especially in the drier positions. Any winter covering of leaves must be removed.

Polypodium vulgare prefers good, light soil in well-drained but moist situations in shade, with no other plants growing with it. It will endure very dry places, but will be dwarfed. Will also do well in full sunlight if soil conditions are good. As a native it grows in positions in which it does not receive any yearly coating of fallen leaves, and, wherever planted, should not be covered with coarse material. Plant perfectly evergreen; height 6 to 10 inches.

Polypodium incanum of Virginia and the South is hardy but not vigorous at Philadelphia.

Polystichum Braunii. This fern needs good deep light loam, not spongy, with humus and shade winter and summer. A distinct and beautiful evergreen fern open to improvement by selection and culture, although belonging to the class of "crown" or "tree" ferns which do not have the chance to vary or "sport" which the species with vegetative roots do.

Polystichum (*Aspidium*) *acrostichoides* should be given shade both summer and winter for best results, and in no case can shade in summer be omitted. The plants will endure sunshine for a few years but will not be thrifty, and will eventually die. One of the more common florists' ferns—the Christmas fern—the sterile fronds of which are gathered and stored by the million for winter use by florists. They are found on the north side of the hills and the best grade grows not in low ground nor where the soil is shallow but where good loam with no winter leaf covering are the conditions. The planting of this fern for the sale of the fronds may become profitable as demands increase and its wild habitats become forbidden grounds to pickers. In culture give (1) northern exposure; (2) good corn land; (3) no loose or bare earth between plants; (4) no grass; (5) no real cover of leaves in the fall. Give with these a good supply of moisture such as the lower half of a hillside can easily be made to receive from the overflow from rainfall on the upper half. There must be good drainage.

Polystichum fragrans. Positions in the wild suggest dense cool moist shade with good drainage.

Polystichum Lonchitis. Grows well under conditions for P. acrostichoides as far south as Philadelphia.

Pteridium aquilinum, to be grown to perfection, should have considerable sunlight, with moist, rich soil, kept cool and loose with a coating of leaves or other material. In such a position it should grow to 4 to 5 feet high, with other dimensions corresponding. However, it will grow in almost any position. It has strong, creeping rootstocks, so that attention is necessary to keep a healthy group within bounds. The earliest fronds put forth die in late summer, but those of later growth remain green until frost, so that with attention to the removal of dead fronds a group will look well until fall. The rootstocks break or crack easily so that plants are injured by transplanting and grow poorly until again established. Early spring is the best time to move plants.

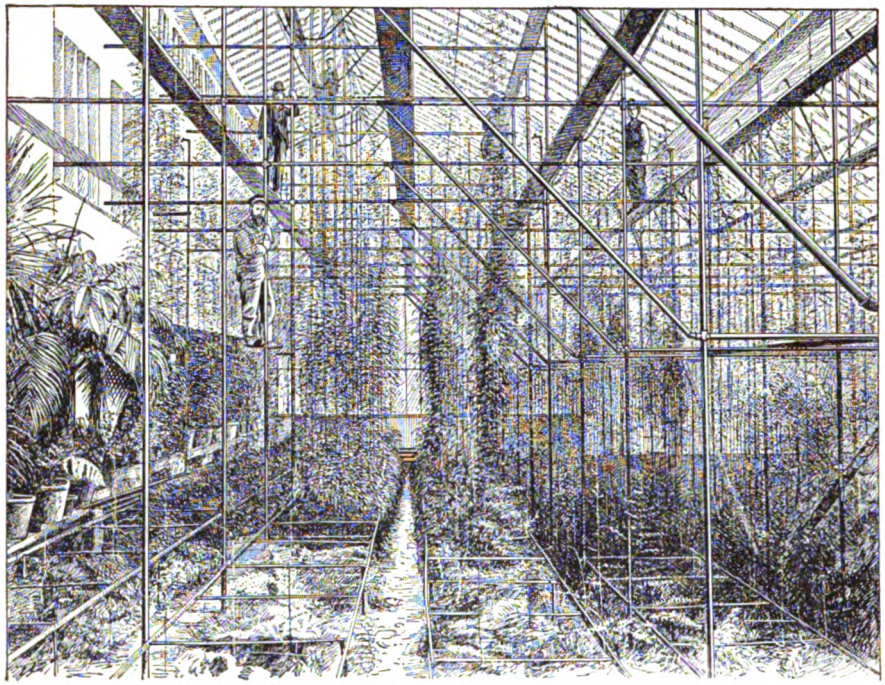
Woodsia. Small rock ferns mostly requiring winter shade and doing best on rock banks facing the north.

Woodwardia angustifolia wants a moist situation in deep shade. Does well in moist peat north of a bank or wall. Will endure full sunlight in positions where it has become established, but will not grow well when transplanted to sunny position. *W. virginica* needs more moisture.

F. W. BARCLAY.

Culture of asparagus fern (Fig. 1492).

The sprays of *Asparagus plumosus* look so much like certain ferns or selaginellas, that the plant is commonly known as asparagus fern; and the cultivation of it is therefore treated at this place. (For the botanical account, see p. 407, Vol. I.) The first and all-important factor in the cultivation of asparagus fern is the construction of the bed. To meet with any degree of success, the bed must have perfect drainage. The house should be 25 or 30 feet high, and wired at the top and bottom. The wires beneath are made fast to each side of an iron trellis about 8 inches apart and at the top an equal distance apart, in order that the strings may be as nearly straight as possible.



1492. A house of "Asparagus ferns."—Asparagus plumosus.

The early growth of *Asparagus plumosus* var. *nanus* is very slow; but as soon as it is transplanted and well rooted in a rich soil, the growth is more rapid, the tender shoots developing into a vine which will be ready to cut for the market in about a year. There is great difficulty in securing the seed of the nanus. In a whole house, there may be only a few seed-bearing strings. After being picked, the berries are allowed to dry for a month, and are then ready for planting. A good, rich soil, covered with a thin film of sand, serves very well to start them. The temperature should be about 65°, and as nearly constant as possible. When the plant is well rooted, it is removed to a deeper soil or potted in 3- or 4-inch pots and placed on a bench. Here it remains a year, and is then placed in the bed.

Up to this time a small amount of labor suffices to keep the plant growing in a healthy condition; but from now on great care must be taken and much labor expended to produce the best crop. The bed into which the young plant is set should be carefully laid with rocks at the bottom, so the water can escape freely. Over this place 2 or 3 feet of soil, manure, and dead leaves. It is but a short time now that the roots have room to expand before the shoots appear above the trellis, and the stringing begins. Strong linen thread is used for strings.

The first crop will not be ready to cut before the end of the second year,—that is, from the time the seed is planted. As soon as this crop is exhausted, new strings are put in place of the old, and another crop is started. This goes on year after year. Now that the plant has gotten its growth, it is more hardy, and is constantly sending up new shoots. If the bed is well made in the beginning, the asparagus need not be disturbed for eight or ten years. However, at the end of that time it is well to take the plants up and fill the beds with fresh soil and manure.

In the spring, when the sun gets high, the asparagus houses are shaded with a light coating of white lead, whiting and kerosene oil. This is absolutely necessary, as the summer sun would in a very short time burn the tops of the vines. The vine flowers in the fall, and only on strings that have been matured six months or more.

The vine alone is not the only source of profit. When the plant is a year old, a few of the most nearly perfect sprays may be taken without injuring its growth. These are very desirable in the market. There is, of course, some waste in working up the Asparagus to be shifted, but on the whole, it is very slight. The different forms in which it is sold utilize by far the greater part of it.

Insects destroy the shoots and sprays. This is prevented to a great extent by insect powder. The cut-worms do the most damage. About the only way to get rid of them is to pick them off the strings during the night, as they generally seek shelter under the thick clusters of the plant at daylight.

There are many drawbacks in growing asparagus, among which are expensive houses, the slow growth of the plants (which makes it necessary to wait at least two years before receiving any return from the expenditure), injury from insects, and the great amount of labor involved in looking after the houses.

WILLIAM H. ELLIOTT.

FERNS, POPULAR NAMES OF. Adder's Tongue F., *Ophioglossum vulgatum*. **Asparagus F.,** *Asparagus plumosus*. **Beech F.,** *Phegopteris*. **Bird's-nest F.,** *Asplenium Nidus*. **Bladder F.,** *Cystopteris*. **Boston F.,** *Nephrolepis exaltata* var. *bostoniensis*. **Brake,** *Pteridium*. **Bristle F.,** *Trichomanes*. **Buckler F.,** *Dryopteris*. **California Gold F.,** *Ceropteris triangularis*. **Chain F.,** *Woodwardia*. **Christmas F.,** *Polystichum acrostichoides*. **Cinnamon F.,** *Osmunda cinnamomea*. **Climbing F.,** *Lygodium*. **Dagger F.,** *Polystichum acrostichoides*. **Deer F.,** *Lomaria*. **Elk's-horn F.,** *Platycerium alcorne*. **Female F.,** *Asplenium Filix-fœmina*. **Filmy F.,** *Hymenophyllum*. **Floating F.,** *Ceratopteris*. **Flowering F.,** *Osmunda*; sometimes also *Anemia*. **Gold F.,** *Ceropteris*. **Grape F.,** *Botrychium*. **Hart's-tongue F.,**

Phyllitis Scolopendrium. **Hartford F.,** *Lygodium palmatum.* **Hay-scented F.,** *Dennstædtia punctilobula.* **Holly F.,** *Polystichum Lonchitis.* **Lace F.,** *Cheilanthes gracillima;* also *Dryopteris intermedia.* **Lady F.,** *Asplenium Filix-fœmina.* **Lip F.,** *Cheilanthes.* **Maidenhair F.,** *Adiantum;* more particularly *A. Capillus-Veneris* abroad and *A. pedatum* at home. **Male F.,** *Dryopteris Filix-mas.* **Marsh F.,** *Dryopteris Thelypteris.* **Oak F.,** *Phegopteris Dryopteris.* **Ostrich F.,** *Matteuccia Struthiopteris.* **Pod F.,** *Ceratopteris thalictroides.* **Rattlesnake F.,** *Botrychium virginianum.* **Royal F.,** *Osmunda regalis.* **Sensitive F.,** *Onoclea sensibilis.* **Shield F.,** *Dryopteris* **F.,** and *Polystichum.* **Stag-horn F.,** *Platycerium.* **Sun F.,** *Phegopteris.* **Sweet F.,** *Myrica asplenifolia;* abroad, various *Dryopteris.* **Sword F.,** *Nephrolepis exaltata.* **Venus' Hair F.,** *Adiantum Capillus-Veneris.* **Walking F.,** *Camptosorus rhizophyllus.* **Wall F.,** *Polypodium vulgare.* **Wall-rue,** *Asplenium Ruta-muraria.* **Washington F.,** *Nephrolepis exaltata* var. *washingtoniensis.*

FERÒNIA (from Feronia, Roman goddess of forests). *Rutàceæ,* tribe *Citreæ,* subtribe *Feroniнæ.* Spiny deciduous tree with hard-shelled fruit; related to Citrus, for which it can perhaps be used as a stock.

Leaves odd-pinnate, deciduous: fls. small, perfect or by abortion male in terminal or axillary panicles; petals 5 (rarely 4 or 6); stamens twice as numerous as the petals; filaments much longer than the anthers, dilated at base and densely pubescent on the sides and within; ovary at first 5-celled, later becoming by confluence 1-celled: fr. with a hard, compact woody shell; seeds oval, lenticular, with a thin hairy brown testa immersed in an acid edible pulp; cotyledons fleshy, aërial in germination.—Only 1 species is known.

Limònia, Swingle (*Schìnus Limònia,* Linn. *Limònia acidissima,* Linn. *F. elephántum,* Corr.). Wood-Apple. Spiny deciduous tree, native to India, Ceylon and Indo-China: bark gray, rough: lvs. odd-pinnate, 3–7-foliate; lfts. opposite, obovate, blunt at the apex, sometimes emarginate, entire-margined with a short petiolule; rachis margined, articulate, spines long and straight, axillary: fls. (sometimes male by abortion of the ovary) dull red, small, in terminal or axillary long-pedicelled panicles; petals 5 (rarely 4 or 6); stamens 10 (rarely 8 or 12), filaments short, dilated at base and densely pubescent on the sides and within; anthers large; ovary 5-celled, with many ovules in each cell; stigma cylindrical, sessile: frs. globose or oblate, 2½–3 in. diam., having a hard, woody rind filled with a pinkish edible pulp in which the numerous woolly seeds are immersed. For discussion of name and synonomy, see Journ. Wash. Acad. Sci. 4:325 (n. 12, June 19, 1914). Ill. Roxbg., Pl. Coromandel., Pl. 141. Gt. 34:1206. Wight, Ic. Pl. Ind. Or., Pl. 45; Beddome, Fl. sylvat. South Ind., 1:121; Talbot, For. Flor. Bombay, fig. 124; Engl. & Prantl, Nat. Pfl.-fam. III. 4, 193, fig. 112. —The pulp of the fr. which is acid, is used for making jellies somewhat similar to black currant jelly. It is also made into a kind of chutney with oil, spices and salt by the natives of India. The fls. and lvs. of this tree have an odor of anis and are used as a stomachic. The commonly cult. species of Citrus can be grafted on this plant and wood-apple seedlings are now being tested as stocks by the U. S. Dept. of Agric. in Calif. and Fla. and also in the greenhouses in Washington, D. C.

1493. Flower and fruit of Feroniella oblata. (Fl. nat. size, fr. ×⅔.)

Walter T. Swingle.

FERONIÉLLA (diminutive of Feronia, Roman goddess of forests). *Rutàceæ,* tribe *Citreæ,* subtribe *Feroniнæ.* Small much-branched spiny tree, related to Feronia and suggested as a possible stock for citrous fruits.

Leaves odd-pinnate, persistent, 3–6-paired; rachis cylindrical, sometimes narrowly winged; spines solitary, in the axils of the lvs.: fls. in much-branched axillary infl., perfect or by abortion male, usually 5-parted, having 4 times as many stamens as petals; filaments much longer than the anthers, dilated at base and having a hairy appendix on the inner side; style long, stigma cylindric, caducous; ovary at first 5–6-celled, later becoming by confluence 1-celled: fr. spherical or depressed globose, with a hard shell composed of radially arranged prismatic elements; pulp edible; seeds numerous, oblong or elliptical, with a smooth crustaceous testa; cotyledons aërial in germination.—Two species are known.

1494. Feroniella oblata. (×⅔)

oblàta, Swingle. Krassang. Figs. 1493, 1494. Spiny tree, 25–65 ft. high, native to Cambodge and Cochin-China: lvs. odd-pinnate, 3–4-paired; lfts. covered with small whitish hairs, especially when young, pellucid-punctate, oval or obovate, crenulate when young, often emarginate, with a very short petiole; rachis pubescent; fls. in many-fld. panicles, white, very fragrant, usually 5-parted, with lanceolate pointed petals; stamens 4 times the number of petals, anthers large, oval, filaments joined together at the base by the woolly pubescence of the appendices occurring on their inner side: fr. borne in clusters of 3 or 4, flattened spheroid, 2 to 2½ in. diam.; pulp subacid, pinkish, edible. Ill. Swingle in Bul. Soc. Bot. de France, 59, pl. 18 and fig. *a,* p. 778. Lecomte, Fl. gén. Indo-Chine, 1:685, fig. 72, 1–5.—This species occurs commonly in the forests of Cambodia and is sometimes cult. by the natives for its frs. which, when young, have a pro-

nounced orange odor and are used as a condiment in sauces. Young plants of this species are growing in the greenhouses of the Dept. of Agric. at Washington, D. C.

lūcida, Swingle (*Fèrònia lùcida,* Scheff.). KAVISTA BATU. Small spiny tree, native to Java: lvs. odd-pinnate, 3–6-paired; lfts. oval or obovate, coriaceous, shiny above, margins entire or slightly crenulate, obtuse or emarginate at the apex; petioles pubescent, the terminal lft. sessile; rachis pubescent, articulated: fls. perfect or by abortion male, fragrant, white, rather large; sepals small, linear, pubescent; petals pointed-oval; stamens 4 times as many as the petals: fr. globose 2½–2¾ in. diam.; seeds small, with a thin hard testa, immersed in the glutinous pulp. Ill. Icones Bogor. 2:149. —The pulp is sometimes eaten in Java, like that of the wood-apple (*Feronia Limonia*). It grows wild in the drier parts of Java and has been intro. into the U. S. where it is being tested by the Dept. of Agric. as a stock for citrous fruits. WALTER T. SWINGLE.

FERRÀRIA (Giovanni Battista Ferrari, 1584–1653, Italian Jesuit, botanical writer and collaborator with the celebrated artist Guido Reni). *Iridàceæ.* Half-hardy bulbous plants from the Cape of Good Hope (and recent species from other parts of Africa), rarely growing more than 6 inches high.

Corm large and irregular: foliage glaucous; lowest lvs. long and linear, the others ovate, clasping, successively smaller, and topped by inflated sheaths from which emerge the fugitive fls.; these have 6 triangular, spreading, crisped, petal-like lobes, marked with many dull colors, as yellow, green, purple and brown; each spathe contains several fls., and the fls. are united at the very base, connivent and cup-shaped below the spreading lobes; the fls. last only from morning to afternoon of a single day, but there is a fair succession; some are visited by carrion flies: fr. an ellipsoid membranous caps.—Only one species, *F. undulata,* is much known in cult., but the other 5 or 6 species of the Cape are doubtless of equal interest. This was known to pre-Linnæan authors as *Flos indicus* and *Gladiolus indicus.* The bulbs should be stored like gladiolus in a dry, warm place, away from mice.

A. *Fls. dull brownish purple.*

undulàta, Linn. St. stout, erect, sometimes exceeding 1 ft: basal lvs. sword-shaped, 1 ft. and more long, flat, clasping and dilated at base; upper lvs. and spathes 1½–2 in. long: fls. 2 in. across, largely dull purple; anthers oblong, with parallel cells. B.M. 144.

AA. *Fls. greenish.*

uncinàta, Sweet. St. short, little branched: lvs. 2–3, linear: fls. 2, the perianth greenish and with narrow very acuminate segms. 1 in. long; anthers small, the cells nearly parallel.

AAA. *Fls. dark purple.*

atràta, Lodd. St. about 6 in.: lvs. about 4, sword-shaped, firm, strongly ribbed, twice longer than st.: fls. 3–4, bright dark purple, 1½–2 in. diam. when expanded; anthers oblong, with cells parallel.

Other names are advertised by Dutch bulb-growers, as *F. canariensis, F. cælestis, F. conchiflora, F. grandiflora, F. immaculata, F. liliacea, F. rosea, F. Pavonia:* these are to be sought under Tigridia. WILHELM MILLER.

FERTILITY of soils: that condition of soils which makes them productive. The elements of productivity are, a full supply of available plant-food, a suitable and continuous supply of moisture, good physical conditions of the soil, coupled with suitable seed and climate.

Land may contain vast quantities of potential nitrogen, potash, phosphoric acid and other plant-food, and yet be unfruitful,—infertile. Most of the potential plant-food in the soil is lazy, or not available in sufficient quantities in a single season to produce maximum crops. Average arable land which contains from 3,000 to 4,000 pounds of nitrogen, an equal amount of phosphoric acid and four times as much potash in the first 8 inches of an acre, may produce only fifteen bushels of wheat to the acre, which requires, with the straw, but twenty-four, thirteen and twenty pounds of these three elements respectively. Therefore, land may contain a great abundance of potential plant-food, and yet not contain enough of that which is available for a full crop. To make land more fertile, one or more of the following means may be employed. Usually deeper and more thorough tillage should first be resorted to, since most lands, by reason of careless farming, contain much inert plant-food. Superior tillage is almost certain to produce fruitfulness, and therefore should be resorted to before more expensive methods are tried. Tillage not only makes plant-food more available, but it improves the physical conditions of the soil, thereby making it more adaptable to the plant; it may also assist in relieving the land of surplus water, and give to the soil the power of retaining stores of moisture by capillary action.

Moisture plays such an important part in productiveness that it may be said to constitute its prime factor. Clay soils are usually composed of such fine particles that water percolates through them slowly, hence the larger part of the rainfall must either run off over the surface, or remain to be evaporated. The aim should be so to prepare the land by subdrainage, plowing and surface tillage, and by introducing at least one crop of tap-rooted plants in the rotation, that the surplus water will filter through the soil in a reasonable time. Percolation of rainwater through soils makes them more friable and warmer in spring, aërates the land, promotes beneficial biological and chemical changes, and brings to the soil the nitrogenous compounds contained in the rainwater. Soils that are reasonably porous have the power of retaining more moisture, and of giving it up to plants, when needed, to a greater extent, than either open sandy or close clay soils. Fertility, which results in fruitfulness, is governed very largely by the water and moisture conditions of the soil, and these, in turn, are to a considerable extent governed by the texture of the land and the amount of humus that it contains.

Legumes, used either as a harvest or cover-crop, promote fertility. A cover-crop of clovers planted August 1, and analyzed sixty-four days after planting, contained nitrogen, in roots and tops, to the acre as follows:

	Tops Pounds	Roots Pounds	Total Pounds
Crimson clover	125	30	155
Red clover	63	40	103
Mammoth clover	67	78	145

Clovers and other legumes may be used to fix and store up the uncombined nitrogen of the air and to digest and make available the mineral constituents of the land, thereby greatly increasing the fertility of the soil.

In most of the semi-arid districts of the United States, except where irrigation can be successfully undertaken in the rich valleys, the problem of permanently maintaining and increasing the productivity of the soil is as yet unsolved. Better tillage may serve in many cases to prolong the time of profitable cultivation, but unless something is done toward restoration it only postpones for a short period the day when the land must be left to the tooth of time and to the growth of such hardy plants as can maintain themselves on a depleted soil. All such pasture lands may be greatly benefited by sowing, even in small quantities, in early spring with red and alsike clover in humid districts, and bur clover in the rainless-summer regions. Lands adapted to orcharding that have become depleted and that have a tenacious subsoil may be benefited by exploding a charge of dynamite

in a hole about 1 inch in diameter and 2 feet deep at each place where a tree is to be set. Such treatment tends to promote filtration, to set free plant-food by aëration and to improve the physical condition of the adjacent soil, while at the same time it lessens the labor necessary to prepare the ground for tree-setting.

Barn manures, when properly cared for and intelligently applied, not only furnish acceptable plant-food but humus as well. Fertility and high productivity usually may be maintained many years by means of superior tillage, leguminous harvest and cover-crops, and the manures of the farm. In some cases a high state of fertility can be maintained only by occasional applications of commercial mineral fertilizers, such as phosphates and potash, but too often expensive fertilizers have been substituted for tillage, leguminous plants and barn manures.

Fertility may frequently be promoted by light applications (ten to twenty bushels to the acre) of quicklime. Lime serves to make plant-food more available, to improve soil texture and to correct acidity. It may also be applied beneficially to a green-manure fallow. Lime tends to sink into the soil, therefore it should be applied after the last plowing preceding the seeding, and should be covered and mixed with the soil by tillage. Hydrated, or biting lime, not only tends to set free plant-food but to flocculate the soil, thereby improving its physical condition. Its use is especially recommended on clay and moist lands and in orchards where the ground is much shaded. Applications of gypsum and salt are sometimes beneficial in maintaining fertility, but they, as well as lime, usually act indirectly, as the soil is seldom deficient in these constitutents so far as they are required as plant-food. On high-priced lands, especially those devoted to horticulture, the soil should be made and kept fertile—well up to its highest productive power.

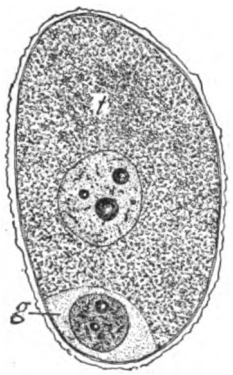
A bare summer fallow of one to three plowings and suitable surface tillage will not only destroy weeds, but liberate plant-food as well, while storing moisture in the soil for the immediate use of young plants. But a bare fallow, if not accompanied by the addition of some plant-food, may hasten the depletion of the soil. It is a matter of judgment, then, as to whether the particular soil contains such abundant supplies of plant-food that some of them may be removed; or whether it is very deficient. In the latter case a green fallow would be far preferable to a bare one. In many cases a bare fallow is merely a method of mining-farming which hastens the time when the land must be turned out to pasture for economic reasons. Often productivity is increased more satisfactorily by means of green-manuring than by bringing plant-food to the land from outside sources. In most of the humid districts early sowed peas (which withstand late frosts) followed by buckwheat, and both plowed under some time before they mature, can be grown in time to fit the land for seeding in September to wheat, rye or timothy, the nurse crop being omitted. When the land might be made too porous by this method, rye sowed in the fall, plowed under before coming to head and followed by peas, would greatly improve the light and sandy soils by bringing stores of nitrogen and humus.

Nature, in producing and storing fertility, provides a great variety of plants and an infinite number of ways of multiplying them so that the land is fully covered with vegetation—except in desert regions. Upon the best of these lands a vast animal life is maintained while the remainder produces other plants to feed other animals. In the densely settled agricultural districts of China, for the last two thousand years the farmers have been returning as much to the land as they have taken from it; and the soil is now more productive than it was when first brought into cultivation. The problem of conservation and restoration of soils is now in America the most serious one the agriculturist has to solve.

Sometimes soils are rendered unfruitful by the presence of deleterious substances, as organic acids or alkaline salts, or a superabundance of some one or more of its usually useful ingredients, as water or nitrogenous compounds. An excess of nitrogen stimulates the growth of stalk and straw at the expense of grain, or in the orchard it tends to the formation of wood rather than to fruitfulness. The acidity should be corrected by lime, as noted above, the surplus water removed by drainage, the nitrogenous matter reduced by the production of such crops as are not harmfully affected by its superabundance, such as forage crops which are prized for their foliage rather than for their seeds, while the alkalinity may sometimes be overcome by deep tillage, irrigation or application of gypsum in suitable amounts.

I. P. Roberts.

FERTILIZATION is the fusion of sexually differentiated cells, and with special reference to the seed plants it means that a cell (a fertilized egg, or zygote) is thus formed which is capable of developing into the embryonic plant later recognized in the plantlet of the seed. The fusing cells, or gametes, are (1) the egg (female cell), which is organized in the ovule, as described below, and (2) a sperm-cell, or nucleus (male cell), developed in the germinating pollen-tube. Fertilization is a process which may not be readily observed in the seed-plants except through the use of careful histological methods, both in the fixation of material and in the subsequent processes of imbedding and staining. The phenomena are illustrated in Figs. 1495–1497.



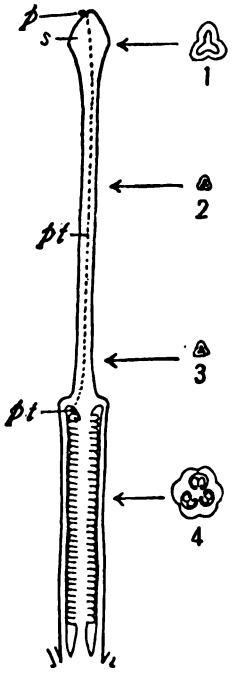
1495. A pollen-grain of Lilium philadelphicum.

Section of a single grain before the anther opens; *t*, the tube-cell; *g*, the generative cell. The large spherical body in each cell is the nucleus. (Magnified 500 diameters.)

The term "fertilization" has always implied the union of male and female cells; but formerly, when less was known regarding the details of the phenomenon, "fertilization" included the mere mechanical process whereby pollen from the anther was transferred by any agent to the stigma of the flower. For this reason "fertilization by insects" or "fertilization by wind"—meaning the transfer of pollen by these agencies—are frequent expressions in the work of Darwin and Wallace. In this last-mentioned sense, the word pollination is appropriate, and now commonly employed. If the silks of corn are pollinated with corn pollen, fertilization normally ensues and seeds are produced; but if the corn-silks are pollinated by the pollen of the lily, no seeds will be formed. It is obvious that cross-pollination has no limits; but cross-fertilization is limited to those cases in which the sexual cells unite and a new organism develops.

The development of some structures essential in fertilization are of interest in this connection. The mature pollen-grain consists of a large tube-cell and nucleus and a small generative cell and nucleus. When lodged upon a suitable stigma the pollen-grain germinates by the development of a tube which enters the loose tissue of the stigma and grows further into the conducting parts of the style. In some cases, definite stylar canals are present, but usually the tube wedges itself between the yielding cells, absorbs nutrient in its course, and forces or dissolves its way to the ovule or seed-case, where, as a rule, it enters the micropyle and approaches the embryo-sac and egg-cell. In its

course the pollen-tube is doubtless "directed" by the distribution of food. Meanwhile, the generative nucleus of the pollen-tube divides into two sperm (male) nuclei, and these migrate to the growing end of the tube.



1496. Outline of a pistil of Lilium philadelphicum.

A lengthwise view of pistil almost through the center; *s*, stigma on which pollen-grain, *p*, has been lodged. The course of the pollen-tube, *pt*, is indicated by broken line. At the right, *1*, *2*, *3*, *4*, are cross-sections of the pistil at the levels indicated by the arrows: *1*, the stigma; *2*, *3*, the style, show the triangular canal which leads into the three chambers of *4*, the ovary, in each chamber of which are two rows of ovules. (Natural size.)

With the formation and opening of the flower, the embryo-sac attains its development. This structure is too complex to require full treatment here, but it is sufficient to say that, when approaching maturity, it consists of one large cell containing eight nuclei, four of which collect at each end of the cell. One nucleus from each end marches to the center, and the fusion which then commonly results gives a nucleus the divisions of which ultimately organize a so-called food, or endosperm, tissue, which may surround the embryo when formed.

At the micropylar end of the embryo-sac, another nucleus organizes the egg-cell—a prominent cell with considerable protoplasm—and the other two degenerate or form the subsidiary cells of an "egg apparatus." The cells at the antipodal end of the embryo-sac are also of little present significance. At about the time of the maturity of the egg-cell the tip of the pollen-tube reaches and penetrates the wall of the embryo-sac, then dissolves and liberates the two male nuclei. One of these fuses with the egg-cell, and this is the important act under consideration. The other sperm nucleus often fuses with the endosperm nucleus, but that does not affect the characters of the embryo. The fusion of egg and male nucleus unites, on the other hand, the characters of the ovule-bearing and pollen-bearing plants in the fertilized egg, which may proceed immediately to develop the embryo.

B. M. Duggar.

FERTILIZERS. It is now well recognized that shade trees, ornamental shrubs, small fruits, and flowering perennials, as well as annual flowering and foliage plants, are often as greatly benefited by the use of proper fertilizers and manures as vegetables and ordinary farm crops. There are, nevertheless, occasional soils on which fruit trees, and shade trees in particular, require little or no artificial fertilization or manuring. For example, it was not found profitable to fertilize apple trees at the Agricultural Experiment Station in Geneva, New York, whereas at the Pennsylvania Agricultural College the use of fertilizers was not only strikingly helpful, but practically vital to successful orcharding. Instances of such contrasts in connection with trees and shrubs are always to be expected. On this account the giving of rule-of-thumb directions for fertilizing, in a work of reference which is designed to be generally applicable to the entire United States, is not only well nigh impossible, but may, if followed, lead to the most unreasonable procedure on the part of those not sufficiently conversant with their own particular soil conditions. For this reason this discussion will be confined largely to the general principles involved, since they not only fail to mislead the novice, but may serve as a safe and rational basis for general procedure for all.

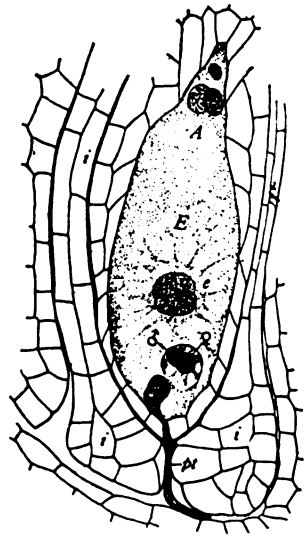
Shade trees, ornamental trees and shrubs.

Because of the fact that trees have an extensive root-system, and hence possess a wide feeding range, they often stand less in need of artificial manuring and fertilizing than certain shrubs, especially if the latter have already been set for a long time.

It is to be presumed that most soils contain enough iron and magnesia to meet the needs of trees and shrubs, yet since these substances are just as essential to their growth as any of the three so-called "essential elements," it is well to bear in mind that very rare cases may be met with in which even iron or magnesia may be helpful. In this connection it may be mentioned that the soil in a section of northern Michigan is said to contain so little iron that certain farm animals, if fed exclusively on the plants which grow there, cannot be reared successfully. It has even been found that manganese compounds are sometimes helpful to plants, and if the supply of iron is insufficient, they aid in promoting chlorophyl formation in the leaves, without which the higher plants cannot exist.

Some soils are relatively deficient in magnesia as compared with lime, and when such is the case, growth is likely to be restricted until enough magnesia is added to create a proper balance between the two. A much more frequent lack, in soils of the humid regions, is lime.

Unfortunately, an extended and systematic study of the lime requirements of trees and shrubs has not yet been made, although many valuable isolated observations are on record. It would be of great value if such experiments were conducted on an extensive scale. Such experiments as were made in this direction in Rhode Island showed, for example, that the American elm (*Ulmus americana*) and the basswood (*Tilia americana*) were both greatly helped by liming when grown on the very acid granitic soil of that state. From this it may be inferred that benefit from liming would also follow on many of the soils of the humid regions which are derived chiefly from granite and from certain of the sandstones, shales, slates, gneisses, schists and conglomerates.



1497. Section of an ovule of Lilium philadelphicum.

Cut lengthwise; *i*, *i*, inner integument, inclosing except at a narrow orifice (micropyle) where the pollen-tube, *pt*, enters the body of the ovule, which is chiefly occupied by the large embryo-sac with three nuclei, one much disorganized. *e*, the endosperm nucleus, just being formed by fusion of two nuclei from the respective ends of the embryo-sac. ♂, male nucleus, which has just migrated from pollen-tube and is about to fuse with ♀, the egg nucleus. The synergidæ, or "egg apparatus," have disappeared. (Magnified 670 diameters.)

The sugar or rock maple was found to be but little helped by lime, even where the elm and basswood showed striking benefit. The common white birch seemed to be even less responsive to liming than the sugar maple.

The use of much

lime may sometimes interfere with the growth of the Norway spruce. It is also unfavorable to at least some of the pines. The effect of liming on certain of these conifers is observable not only by way of its lessening the growth of the tree, but also by its causing a shortening of the needles.

The chestnut tree is reputed not to need liming, but even to be seriously injured, if lime is used.

Among the flowering shrubs, general experience points to the fact that lime should be avoided in connection with the growth of the laurels, rhododendrons, azaleas and the Ericaceæ generally. There is, however, no doubt as to the benefit to be derived from the use of lime in connection with many of the other ornamental and flowering shrubs. Experiments by Hogenson appear to show that sulfate of magnesia may sometimes be very helpful to certain shrubs which are ordinarily injured by lime, although this work needs to be extensively supplemented before being accepted as a sure basis of procedure.

In general, the need of nitrogen for trees and shrubs is indicated by insufficient limb and leaf growth, although any other lacking essential ingredient may ultimately have the same limiting effect.

Whenever trees or shrubs are being set in poor land, it is well to work into the soil generous amounts of ground, steamed bone or superphosphate. The latter phosphate possesses, however, a very distinct advantage for subsequent application, due to its high content of soluble phosphoric acid. Basic slag meal should be avoided for those trees and shrubs likely to be injured by lime, whereas for others it may be employed at the time of planting. These materials may be used when the trees or shrubs are set, if well mixed with the soil, and from one to four pounds may be used for a tree or shrub, according to their size.

High-grade sulfate of potash or muriate of potash may be similarly worked into the soil at the rate of half a pound to a pound a tree when potash is known to be deficient, but even in such cases it is sometimes advisable to withhold it until a year after setting, and then make the application alone, in conjunction with superphosphate, or in a complete fertilizer. Twice as much double manure salt or four times as much kainit is required to replace either the sulfate or the muriate of potash.

If the growth is not satisfactory, after the trees or shrubs have been set for some time, a complete fertilizer containing from 2 to 4 per cent of ammonia, from suitable sources, may be worked into the soil about the trees or shrubs, or it may even be scattered on the surface of the ground, in case the land is kept in grass.

Care should be taken to keep the fertilizer away from the base of the trees or shrubs, and it should be applied for at least a considerable distance beyond the reach of the branches. For this purpose, quantities of fertilizers, ranging from two to thirty-five pounds, may be used for each tree, according to its kind, size and age, although even for large shrubs, from two to six pounds will usually be sufficient.

Just as the keen observation of the feeder is necessary in the fattening of the animal, so also the judgment of the experienced gardener is essential to the proper gaging of the amounts of fertilizer for trees and shrubs of all kinds.

Much is claimed, by those who have had experience in renovating old trees, for the plan of making a large number of holes under the tree, to a depth of 1 foot to 2½ or 3 feet, and placing the fertilizer in these holes. This procedure has much justification, owing to the great "fixing" power of the soil, especially for phosphoric acid and potash salts which are otherwise prevented from being quickly and readily carried down in large quantities to points where the deeper roots can immediately reach them. Even if fertilizer is employed in this manner it is also well to apply some of it to the surface, in order to insure an even lateral distribution of at least a part of it.

Another drastic method of procedure in renovating old trees is to trench around a part or the whole of the tree, at a suitable distance from the trunk, to a depth of several feet, and then fill the trenches with new soil mixed with manure and a complete fertilizer containing slowly-acting phosphatic and nitrogenous materials, and suitable amounts of potash salts. In such a case it is a part of the plan to cut off many of the ends of the old roots in order to make them branch and thus increase their feeding capacity.

Apples and pears.

Apple trees, as a rule, respond to liming rather better than pear trees; nevertheless, on very acid soils there are several good reasons for liming even pear trees. An occasional application of magnesian lime may be desirable, but if used it should be alternated with applications of purer lime.

On land known to be very rich naturally, or which has been highly manured for a series of years, neither fertilizer nor manure will be required for newly set apple or pear trees, and in only exceptional cases will they be needed, even for those just coming into bearing. When such exceptional conditions do not exist, it is usually a safer plan to fertilize the land with liberal amounts of potash, phosphoric acid, and rather slowly available sources of nitrogen, or else to employ such small amounts of quickly available nitrogen as will surely be used up before or by midsummer. If, on the other hand, excessive amounts of farmyard manure or nitrogenous fertilizers are applied, or if the application is too long delayed, late growth is promoted, with the result that the wood remains too soft. In such cases cracking and other serious injury is likely to follow during the winter season.

As a rule, the orchard may be used to advantage for some years after the trees are set, for the growing of quick-maturing crops, such as peas, early cabbages, radishes, and potatoes, or even for tomatoes, melons, or squashes. These crops may be well fertilized, and many of the earlier ones can be followed in the late summer by a cover-crop of crimson (scarlet) clover, or hairy vetch. If the soil is already rich enough, or is too rich, in nitrogen, barley or rye may be substituted for the legumes. These cover-crops can then be plowed under the next spring. Some growers even prefer weeds to any of these cover-crops because of saving the outlay for seed.

When the stage is passed in which extended cropping between the trees is possible, and the burden of fruit becomes great, especial care should be taken to apply an abundance of potash and phosphoric acid annually, and only enough nitrogen from legumes or fertilizers to insure adequate foliage, satisfactory wood-growth, and abundant fruit-spurs. For this purpose a suitably compounded complete fertilizer may be employed. If legumes are found to supply enough nitrogen one may employ annually from 200 to 600 pounds an acre of acid phosphate or basic slag meal, and from 50 to 400 pounds an acre of the muriate or high-grade sulfate of potash. If the double manure salt is used as the source of potash instead of the muriate or the high-grade sulfate of potash, the total application should amount to approximately twice as much an acre, because of its lower potash content.

The nitrogen for the orchard may be supplied in one, or, on light open soils, in two applications of nitrate of soda at such a rate that the total application for a season will not exceed from 100 to 300 pounds an acre, dependent upon the slowness of the growth of the trees. It is usually much simpler to make a single application of a complete fertilizer, in which the nitrogen is present in nitrates, ammonium salts, soluble organic compounds and in less quickly available

organic forms, than to apply nitrates at two or more different times. When such complete combinations are used the danger of loss by leaching is greatly lessened and a satisfactorily continuous but properly decreasing supply of nitrogen for the trees is assured. The fertilizer application should not be made later than just after the time the fruit has set. Many good authorities even advise waiting until this time in order to gage the application according to the probable yield and requirement of the trees.

At the Massachusetts Agricultural Experiment Station, far better results were secured with double manure salt (sulfate of potash and sulfate of magnesia) than with muriate of potash, but in experiments elsewhere the muriate of potash has given as good results as the high-grade sulfate of potash. It is probable, in view of the known lack of carbonate of lime in the Massachusetts soil, that this rather serious deficiency was responsible for the poorer results with muriate of potash, for in soils elsewhere where the lime supply was sufficient, muriate of potash has acted well. It is, of course, possible that the magnesia of the double manure salt was helpful in the Massachusetts experiments. The results furnish, however, no positive evidence to that effect, but indicate strongly that the chlorin of the muriate of potash was probably injurious because of a lack of carbonate of lime.

The idea that the proportion of the various fertilizer ingredients affects the color of apples in a direct way has little to support it. It is rather tenaciously claimed, nevertheless, that basic slag meal has special value in adding color to apples, but this may be due solely to its adding a proper balance of mineral ingredients which could perhaps be equally well supplied by other phosphates. There is abundant evidence, however, that over-fertilization with nitrogen leads to the development of exceptionally heavy and abundant foliage; and the excessive shading lessens the color of the fruit. Direct exposure of the apple to the sunlight also lessens its tendency to shrivel. This is due, probably to its effect either on the proportion of the various chemical constituents of the skin, or to its thickness, by which evaporation of water is hindered. In order to insure even distribution of the color on the individual apples, severe thinning is essential, for otherwise one apple will partially shade another.

In some European countries the fertilizer for orchards is placed from 4 to 5 inches deep in holes 20 inches apart, at the rate of about an ounce and a quarter a hole. This method is, however, probably too expensive to employ in this country, though it may be especially effective for orchards which are in sod. If the work were capable of being done by machinery or by some suitable implement the method might possibly prove of economic value.

Peaches.

Peach trees are less in need of lime than apple trees, yet liming is nevertheless often desirable, even for its indirect benefits. The fertilizer required for peaches is much more than for apples, for the reason that the trees grow far more rapidly and bear early and abundant crops. On poor soils generous fertilizing must be provided from the outset, but if the land is very rich or heavily manured, fertilizer may be omitted for the first year or two. If a soil is very poor it should receive at the outset from 300 to 500 pounds an acre of a fertilizer containing a moderate amount of nitrogen derived from appropriate materials, a fair quantity of available phosphoric acid, and a generous amount of potash in muriate of potash. On soils in which potash is naturally very abundant, the supply can be greatly lessened.

When the peach trees come into bearing, more nitrogen will be required than at the outset, and the total quantity of fertilizer may then be increased one-half, or even more than doubled. In the case of peach trees, constant watchfulness is required to make sure that neither too little nor too much nitrogen is used. An excess of nitrogen will prevent proper ripening of the fruit, and of the wood in the autumn, whereas too little will mean abbreviated crops, loss of vigor, and at the same time the lack will create conditions favorable to disease. In any case, ample supplies of phosphoric acid and of potash, as muriate, should be provided to meet any possible need. If a little extra nitrogen is required in the spring, it may be applied in nitrate of soda, or, if the soil is properly limed, sulfate of ammonia may be substituted for the nitrate of soda if desired.

In case one wishes to stock the land with phosphoric acid in advance, large applications of bone or basic slag meal may be made, ranging from 400 to 1,000 pounds an acre of the former and from 500 to 1,200 pounds an acre of the latter. The old plan of heavily stocking the soil and waiting a long time for the returns is, however, giving way to the frequently more economical plan of more nearly meeting the fertilizer needs from year to year, instead of tying up a large amount of money in a long-time investment.

Plums, cherries and apricots.

The plum and cherry, regardless of whether the latter is a sour or sweet variety, are certainly far more in need of liming than the peach, but data are not at hand as to the relative requirements of the peach and apricot. The fertilization of these fruits should not vary widely from the treatment required for peaches, excepting that the quantity may be rather less, and the same care should also be exercised not to use excessive amounts of nitrogen.

Blackberries, raspberries, gooseberries and currants.

The blackberry is especially at home on very acid soils and a very light application of lime will meet all possible requirements of the plants, if indeed it is needed at all. The blackcap raspberry is more likely to be helped by liming than the blackberry, although it is well adapted to moderately acid soils. The Cuthbert raspberry is appreciably helped by liming on quite acid soils, and the same is probably true of most or all of the red and yellow varieties. The gooseberry and currant, including the white and various red varieties are greatly benefited by liming. As much as two to four tons of ground limestone an acre, or its equivalent of slacked lime, are often very helpful to these plants. Raspberries, in particular, thrive well on a heavy, freshly rotted sod, as for example, on old grass land plowed the autumn before the plants are set. In many cases all that is required on such land is to supply an adequate mixture of an available phosphate and a potash salt, but whenever the cane growth is weak and unsatisfactory, or, when gooseberries and currant bushes do not show satisfactory growth, a moderate amount of complete fertilizer containing a fair amount of nitrogen in gradually available forms is likely to be beneficial. The use of heavy applications of nitrogen for raspberries, currants and gooseberries is not advised, for it will induce too great a growth of canes and foliage and interfere with the maturing and ripening of the fruit. The plants will also be rendered more readily subject to mildew.

Strawberries.

The strawberry grows well on moderately acid to very acid soils, and if lime is used the application should be light, rarely exceeding 1,000 to 2,000 pounds of ground limestone an acre.

An important point to be recognized by strawberry-growers is, that weak plants are not likely to be heavy bearers the next year. In consequence, the plants when set should be supplied with a fertilizer reasonably

rich in available nitrogen. This fertilizer should usually be applied at the rate of 1,000 to 1,500 pounds an acre at the time of setting, and in the later years just after picking the crop of fruit, fertilizer may be scattered in a furrow turned away from each side of the bed, after which the furrow may be turned back again. Early each spring fertilizer should be applied broadcast over the beds. This should contain liberal quantities of soluble phosphoric acid and potash but only enough nitrogen to promote reasonable growth. This nitrogen should, however, be largely in readily soluble and available form. If too much nitrogen is used in the spring the fruit will lack color, and it may be soft and unsatisfactory, especially for distant shipment. It may even be necessary to omit all nitrogen in the spring, if the soil is exceptionally rich in humus or has been well manured previously. This can only be decided by the observant grower.

On many soils superphosphate is preferable to basic slag meal as a source of phosphoric acid for strawberries, for the reason that too much lime is to be avoided, and furthermore, the phosphoric acid is largely soluble and better adapted to top-dressing. On an exceedingly acid soil the use of basic slag meal may be permissible for application at the time of setting, for the action of the soil aids in rendering it available to the plants.

Grapes.

Grapes may show some gain from the use of lime under certain circumstances, but they do not require it in even approximately the same degree as the cherry, plum, currant, and gooseberry. The chief need of this crop is available phosphoric acid and potash. If nitrogen is used, the quantity must be carefully regulated, and in Europe slow-acting forms of organic nitrogen are in special favor. Basic slag meal or bone-meal may be used as sources of phosphoric acid when the grapes are set, but later, superphosphate is to be preferred, especially if it is not most thoroughly worked into the soil. Sulfate of potash is often considered preferable to the muriate of potash for grapes, for it is alleged to give a better quality of fruit.

Quinces.

The quince responds to liming in about the same degree as the cherry and plum. It should receive enough nitrogen to insure reasonable growth, but no more; and on exhausted soils a moderate amount of available phosphate and muriate or sulfate of potash will be helpful.

Cranberries.

The cranberry thrives better at the outset, even on certain very acid soils, than after its acidity has been lessened by liming. If more nitrogen is needed than that naturally available from the humus of the bog, it is usually recommended that it be applied in small quantities, as nitrate of soda or preferably as nitrate of potash, provided the bog is already fairly dry and is likely to remain so; but if wet, sulfate of ammonia may be better The chief need of the cranberry vine is usually phosphoric acid and potash. The phosphoric acid for top-dressing may be in superphosphate, but if applied just before the plants are set one may employ bone-meal, or, if on very acid peat or muck soil, even raw rock phosphate.

In case spring applications of fertilizer are made, it must not be expected that they will always affect the cranberry yield of that particular season as much as the yield of the crop which follows. Such applications should ordinarily be made after the water is drawn off and the land has dried out to a reasonable extent. It is often helpful to apply fertilizer just after the cranberry crop is harvested, but late spring applications develop stronger vines for the next season.

Pineapples.

The requirements of the pineapple crop vary widely, dependent upon the rainfall and soil conditions. Where the winter season is likely to be fairly cold, nitrogenous fertilizers should not be applied in the autumn, for otherwise injury from frost may follow. Nevertheless, potash salts have sometimes been used at that time with good effect. On certain acid soils, liming is necessary at fairly frequent intervals in order to bring out the best effect of superphosphates. If lime is not used, bone-meal or basic slag meal may sometimes be preferable to superphosphate as sources of phosphoric acid. From one and three-fourths to two tons of fertilizer an acre, annually, have been recommended for pineapples by the Agricultural Experiment Station of Florida. It is said that the fertilizer should contain 5 per cent of nitrogen, 4 per cent of available phosphoric acid and 10 per cent of potash, in order to meet the conditions in that state. During the first year and a half the applications of fertilizer are made four times a year, but after this period of time is passed, the first application of the year is made either in February or March, and the second after cutting the summer crop. It is obvious that this rule might require modifications on other soil and also as influenced by different climatic or other local conditions.

Table beets, mangels, sugar beets and Swiss chard.

These plants are among the vegetables most in need of liming. Certain of them also have much greater ability than the cabbage and turnip to appropriate from the soil the required supply of phosphoric acid, for beets have been found to yield fair crops where cabbage plants, on account of a lack of available phosphates, failed to develop salable heads.

These plants are able to profit to a considerable extent, as concerns physiological functions, by the soda of nitrate of soda, provided the supply of potash is insufficient, yet it is unwise to limit the supply of potash intentionally, in order to bring out this action, for if this is done the net loss in crop due to insufficient potash may more than offset the advantage of attempting to make the soda fully effective.

All of these plants and many others take up, in varying degrees, considerable more mineral matter than is represented by the sum of the minimum requirements, as determined for each essential ingredient in the presence of an abundance of all of the others. If, therefore, the fertilizer contains soda, it will be taken up in considerable amounts by the plant to satisfy this "luxury" or "excess" consumption in conjunction with the potash physiologically necessary to the plant. Thus the extra potash which would otherwise be taken up to satisfy this excess in the mineral requirement is conserved in the soil for future crops. The use of nitrate of soda, therefore, as one of the ingredients of a fertilizer for these crops, results in insuring the crop against a shortage of potash and prevents the plants from taking up an unnecessary excess of potash, provided an abundance is already present in the soil or is supplied in the fertilizer.

In Europe, beets of all kinds, and especially mangels, have been found to respond very favorably to nitrate of soda in comparison with the results with sulfate of ammonia, yet with certain cereals the yields, under similar conditions, have been larger with the latter. Notwithstanding this favorable action of nitrate of soda on these crops, it is so subject to loss by leaching that it is often better on very open soils to use it in conjunction with several other forms of nitrogen, rather than alone. This is especially true in consequence of the frequent occurrence, in certain sections of the country, of very sandy and gravelly soils and especially in view of the long period of growth of the chard, sugar-beets and mangels.

These crops all require generous supplies of nitro-

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gen, a fair amount of available phosphate, and high percentages of potash. In the case of sugar-beets, if grown for their sugar-content, the proper relationship of these fertilizer ingredients to one another is of great importance.

Cabbage, kale, cauliflower, brussels sprouts, turnips and kohlrabi.

These crops are all remarkably helped by liming on soils which are fairly acid. Liming, especially with caustic or slaked lime, has a tendency to lessen the development on these plants and on turnips, of the disease known as "club-foot" and "finger-and-toe."

What has been said of the action of the soda of the nitrate of soda, in connection with beets, is true also to a considerable degree of these crops; nevertheless, when the period of growth is long and the soil is either a heavy silt or clay, or exceptionally open and subject to leaching, a combination of several sources of nitrogen in the fertilizer, is usually preferable. The reference to heavy silt and clay soils is made in consideration of the fact that sodium carbonate is left as a residual product after the plant has taken up the nitric acid of the nitrate of soda; and this sodium carbonate tends to deflocculate such soils and make them stiffer and more difficult to work than before.

Heavy applications of nitrogen are required for all these crops and some of them, as shown at Rothamsted and elsewhere, are more dependent than beets upon generous supplies of soluble and available phosphoric acid. These plants require also large quantities of potash.

The Swedish turnip, or rutabaga, usually responds to liming rather more than the flat turnip, although lime is often very helpful to the latter.

Several of these plants are especially dependent for their quality on rapid growth; hence, the nitrogen and phosphoric acid must be derived, to a large extent, from readily available materials.

One or two experimenters in this country who have grown turnips in pots and boxes claim to have found that the turnip can utilize rather unavailable forms of phosphoric acid, yet these results need further substantiation in the field before their final acceptance, and in the light of the past field evidence, generous fertilizing with soluble phosphates appears to be desirable. These plants, like the group described previously, respond to liberal amounts of potash salts, yet these salts seldom give very satisfactory results unless they are used in conjunction with liberal amounts of superphosphate and nitrogenous fertilizers.

Carrots and chicory.

The carrot is less likely to show benefit from liming than most root crops, and chicory is even subject to injury by lime when carrots are slightly benefited. Owing to their long period of growth the nitrogen supply for these plants should not only include small amounts of nitrates and ammonium salts, but also soluble and insoluble organic nitrogen, in order that some of the nitrogen may be continually at the disposal of the plant throughout the growing season. These plants are dependent upon reasonable supplies of phosphatic manures, and generous amounts of potash are likewise highly essential. The carrot responds in a less degree than mangels, to applications of soda.

Spinach, lettuce, endive and cress.

These plants are all likely to be greatly benefited by liming, even on soils of moderate acidity. Because of the fact that the quality and market value of these plants depends upon their making a rapid growth, large amounts of immediately available plant-food are essential. Some of the nitrogen should be present in the fertilizer in nitrates, some in ammonium salts and some in quickly available organic forms. No attempt should be made to economize unduly in the use of readily available phosphates and potash salts, for the reason that these crops must have ample supplies of both. The growth of early lettuce, and of spring spinach in particular, may often be pushed forward with remarkable rapidity in the early spring by the use of fertilizers containing generous amounts of nitrates. In fact, these crops may be brought to maturity by such means much faster than by the sole employment of farmyard manure, especially if the manure is poor in nitrogen and not thoroughly rotted.

Onions.

The onion will not thrive and mature properly on highly acid soils which are extremely deficient in carbonate of lime. It is often possible, where fairly good crops can still be grown without the use of lime, nevertheless to hasten the maturity of the onion crop from ten days to three weeks, by its employment. A lack of lime is often one of the causes of thick necks and of failure to ripen properly.

Since the onion crop is planted very early in the season, and because of the consequent opportunities for the loss of nitrogen if too large a part of it is applied in nitrates, appropriate proportions of nitrogen in ammonium salts and in suitable organic forms should also be employed in order to insure an adequate supply as needed.

Generous amounts of potash are required by these crops and it is of vital importance to use for the onion a large amount of superphosphate, because of the fact that it, like lime, hastens the maturity and the proper ripening of the crop. It is also equally important not to use such a large amount of nitrogen as to make it out of balance with the potash, and in particular with the phosphoric acid, for if this is done growth will be unduly prolonged, the onions will have thick necks, and they will not ripen satisfactorily nor quickly.

Potatoes.

Fertilizers for potatoes must be very different according to the section of the country in which they are grown. For example, in the North, where the season is short, the nights cold, and where the crop must be hurried along to the utmost, unusually large proportions of nitrates and of ammonium salts are indispensable, whereas in warmer regions, organic sources of nitrogen may be employed more largely, or perhaps in some favorable cases, they may be used exclusively. The potato crop is in need of quite large quantities of nitrogen, ranging usually from forty to ninety pounds an acre.

The percentages of potash required in potato fertilizers should be adjusted more particularly with reference to the locality, and whereas in many of the potato regions of New England 200 pounds of potash (equivalent to 400 pounds of muriate of potash) are considered necessary for each acre, the quantity could be reduced to one-half or even less in certain portions of the Middle West, or it might perhaps in some exceptional cases be omitted altogether.

For several reasons it is important to insure high percentages of soluble and available phosphoric acid in potato fertilizers, since it often becomes the limiting factor in potato-production over large areas of the United States.

The effect of the fertilizers may be somewhat nullified or intensified, according to the choice of seed. In all cases, seed which has heated or which has been exposed to frost, should be avoided. It has also been shown at the Agricultural Experiment Station in Rhode Island that, if other things are equal, seed tubers which are rich in nitrogen will usually give larger crops than those in which the nitrogen-content is low. The advantage of the high nitrogen-content of the tuber becomes magnified in case they are sprouted once or twice

before planting. No amount of nitrogen applied in the field appears to be able to offset finally and fully the disadvantage of the tubers with the low nitrogen-content. This doubtless explains the advantage of early dug potatoes, for seed purposes, as compared with those which are allowed to mature, for the former are usually richer in nitrogen.

Asparagus.

Sandy soil is ideally adapted to the growing of asparagus. Nevertheless, whenever it is intended to establish a plantation on land of this character, it is wise to turn under considerable stable manure or else a heavy leguminous crop such as hairy vetch. If this is done, the general soil conditions are rendered much more favorable and the asparagus has a better chance to gain a good foothold. Wherever the land needs liming, some lime should be plowed under and a further application should be made on the surface after plowing. The land should then be thoroughly harrowed or otherwise tilled.

Fine ground bone and basic slag meal have been used for asparagus very successfully when worked into the soil at the outset, although the latter is rather better adapted to it on account of the greater availability of the phosphoric acid and the fact that it contains considerable lime.

Some of the best growers of asparagus, on sandy soils, have found that muriate of potash is a better source of potassium than the sulfate.

In humid regions fertilizers for asparagus should contain a considerable amount of nitrogen in nitrates, though other forms of nitrogen are also particularly to be desired on light soils, such as those usually employed for this crop, because of the danger of the loss of nitrates by leaching. It is obvious that, for top-dressing, superphosphate is preferable to any other form of phosphoric acid, because of its greater solubility. An ideal fertilizer for asparagus should contain superphosphate, potash salts, and high percentages of nitrogen, a part being derived from nitrates, some from ammonium salts, and also some of it from organic sources.

Sandy soils are likely to be very deficient in phosphoric acid; hence, the quantity of this ingredient should be high. The fertilizer should likewise carry a high percentage of potash on sandy soils, excepting in regions in which it is known not to be needed. Although potash is usually the least deficient element in the sandy soils of humid regions, the demand of the asparagus plant on this ingredient of fertilizers is so great as to make its use profitable, whereas on other sandy soils in semi-arid regions, potash might not be required.

Melons.

On soils that are very acid, it is imperative to use considerable quantities of lime for canteloupes and muskmelons. Such soils will, nevertheless, produce good crops of watermelons, even if liming is omitted, and heavy liming with slaked or burned lime may, in some cases, even decrease the yield.

Owing to the fact that these crops are generally grown on light, gravelly or sandy soil, a fertilizer is demanded for humid regions containing a fairly high percentage of nitrogen. This should be represented by nitrates, to a still greater extent by ammonium salts, and a part should be from suitable organic sources. It should also contain a high percentage of soluble and immediately available phosphoric acid and generous amounts of potash in order to bring the crop to maturity as rapidly as possible. Plants of this character which have an extensive amount of foliage, usually require high percentages of potash. Special care should be taken to keep the fertilizer from coming in contact with the seed.

Squashes and pumpkins.

The common summer squash, as well as the Hubbard and crookneck varieties, are less in need of liming than canteloupes or muskmelons. Nevertheless, on very acid soils liming is decidedly helpful. These crops are all heavy feeders on nitrogen, a considerable part of which should be in immediately available nitrates and ammonium salts. Moderately high percentages of soluble and available phosphoric acid are necessary, although the summer squash, at least, responds much less to phosphoric acid and more to potash than the cereals and most other cultivated crops. On this account, the percentage of potash in fertilizers for squashes should be high, excepting, of course, where the soils are already rich in available forms of this ingredient.

Celery.

Celery is a crop that will thrive well on slightly acid soils. Nevertheless, where the acidity is great, liming is very beneficial. The quality of this crop depends very largely upon its making a rapid and steady growth. On this account a constant water-supply is one of the most important features connected with its culture. It is of the highest consequence that celery should have a large supply of nitrogen embracing suitable proportions of nitrate nitrogen, ammonium salts and organic materials. Fair amounts of soluble and available phosphates are desirable, and on the muck or peat soils where this crop is frequently grown, especially large quantities of potash should be employed, since this is the fertilizer ingredient which they lack to the greatest extent. The form of potash usually preferred on such soils is the muriate, although frequently kainit is said to have given excellent results. Either is perhaps preferable to the high-grade sulfate of potash or to the double manure salt.

Cucumbers.

Cucumbers are considerably more in need of liming than squashes. In other respects they should have essentially the same fertilizer treatment. Great care should be taken in connection with squashes and pumpkins, as well as with cucumbers, not to allow the seed to come in close contact with the fertilizer, or, indeed, with soil into which large quantities of fertilizer have been introduced. If fertilizer is used in the hill it is well to have it thoroughly incorporated with the soil. Subsequently, this soil should be covered with fresh earth before the seeds are planted.

Tomatoes.

The tomato will grow quite well even on soils that are distinctly acid. Nevertheless, moderate liming is often helpful. When tomatoes are grown in greenhouses it has been found that very large quantities of lime are helpful, by virtue of lessening the tendency to certain diseases, but the necessity for it is less in the field because of the lower temperatures and less humid conditions.

In order to hasten the ripening of this crop, it is very important to have large quantities of soluble and available phosphoric acid, and abundant potash in the fertilizer. One of the most important features is to have the nitrogen supply so regulated as to bring about at once a rapid and vigorous growth of the plants, but the quantity must not be so great as to prolong the growing period unduly, since this will prevent early ripening; and it is a well-known fact that the early fruit generally sells for a much higher price than that which matures later. Furthermore, a large proportion of the nitrogen should be present as nitrates and ammonium salts which can be readily utilized. It is also desirable to apply the entire amount at the time when the plants are set, or, at least, very shortly afterward, for if successive applications are made at a later

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date they will result in prolonging the growing period and delay the ripening of the fruit.

Peas and beans.

Peas are usually much more helped by liming than beans. The latter vary widely in their lime requirement as shown by the fact that on a soil so greatly in need of lime that the Golden Wax and Low's Champion (a green-podded variety) will scarcely produce half a crop, the pole Horticultural bean is only slightly benefited, and the lima bean is practically indifferent to it.

Notwithstanding that these plants are capable of assimilating atmospheric nitrogen, it is nevertheless usually desirable, especially when they are grown to be marketed in the green state, to employ a fertilizer containing a small or moderate amount of readily available nitrogen. This will aid in developing a root-system until such a time as the plants can draw their nitrogen supply to a considerable extent from the air.

Peas and beans also require moderate amounts of potash and phosphoric acid, in fact much more than would be the case if they did not grow so rapidly, and hence reach the crop-producing stage in a short interval of time. The common white field bean has been found to require potash more than phosphoric acid, under conditions in which the cereals and the common farm crops showed a greater response to the latter.

H. J. WHEELER.

FÉRULA (old Latin name, perhaps from the verb *to strike;* possibly the stems were anciently used as ferules). *Umbellíferæ.* GIANT FENNEL. Hardy striking herbs, prized for their spring and early summer foliage.

Stout perennial glabrous usually glaucous thick-rooted herbs, of perhaps 50 species in S. Eu., N. Afr., and W. Asia: lvs. pinnately decompound, the ultimate segms. filiform or small (rarely broadish and dentate): fls. small, in elevated compound many-radiate umbels; petals broad, mostly ovate-acute, the point often inflexed: fr. orbicular or ovate, plano-compressed, membranous-bordered.—The giant fennels are valued for the excessive fineness with which their foliage is cut, and their clusters of perhaps 40–50 umbels of minute yellow fls. borne on stout sts., which rise far above the foliage. In spring the masses of foliage are very refreshing. The bold fl.-sts. make the plants useful for bordering plantations and for stream sides. The ferulas yield gum-ammoniac, galbanum and asafetida. The genus is now held to include Narthex, Scorodosma and Euryangium. These plants are not to be confounded with the true fennels, which belong in Fœniculum. Ferula is closely allied to Peucedanum. The species are difficult to represent in herbaria, and they are confused.

communis, Linn. COMMON GIANT FENNEL. Robust, 8–12 ft.: lvs. light green, very numerous, forming a fine mound or clump, the segms. linear-setaceous; lf.-sheaths very large: fls. yellow; central umbel on a branch nearly sessile, and the surrounding ones stalked and mostly male. S. Eu. to Syria.—Presumably the *F. gigantèa* of trade lists belongs here, although *F. gigantea,* Fedtsch., of Cent. Asia, is recognized botanically.

Var. **brevifòlia,** Mariz. (*F. brevifòlia,* Link. *F. Linkii,* Webb & Berth. *F. nodiflòra,* Guss.). Ultimate lf.-segms. shorter than in the type. The gum-ammoniac of Morocco comes from this plant. B.M. 8157. See history in Kew Bulletin, 1907, pp. 375–388.

tingitàna, Linn. (*F. sáncta,* Boiss.). Robust, the st. leafy below, paniculate-corymbose above: lvs. triangular-ovate, quarternate pinnatisect, the segms. narrow-oblong and cut: fls. orange, in globose umbels. N. Afr. B.M. 7267.—Long supposed to be the source of gum-ammoniac. Probably not in the trade.

glaùca, Linn. (*F. neapolitàna,* Tenore). Very tall (to 14 ft.), branching: lvs. large, pinnately decompound; segms. flaccid and broad-linear, obtusish and 1-nerved, green above and glaucous beneath: bracts at base of peduncles membranaceous, oblong, deciduous: fls. yellow, in many umbels. S. France to Dalmatia. G.C. III. 32:441, 442.

F. Assafœtida, Linn. (Assafœtida disgunensis, Kaempf. Scorodosma fœtidum, Bunge). St. 6–12 ft., very stout and much-branched: lvs. puberulous and minutely glandular or somewhat tomentose, the radical ones large and ternatisect with segms. oblong-lanceolate and obtuse: umbels on fleshy peduncles, 20–30-rayed, the fls. yellow. S. W. Asia. G.C. III. 32:443. An evil-smelling plant, one source of the drug asafetida.—*F. Nárthex,* Boiss. (Narthex Asafœtida, Falconer). St. 6–8 ft., with large sheaths: lvs. pubescent when young, 1–2 ft. long, ovate, the segms. either entire or irregularly serrate. S. W. Asia. B.M. 5168. A source of asafetida. A specimen described in G. F. 3, p. 523, required 16 years to attain sufficient strength to bloom.

L. H. B.

FESTÙCA (ancient Latin name for a kind of grass). *Gramíneæ.* FESCUE-GRASS. Annual or perennial grasses grown for ornament or as pasture grasses.

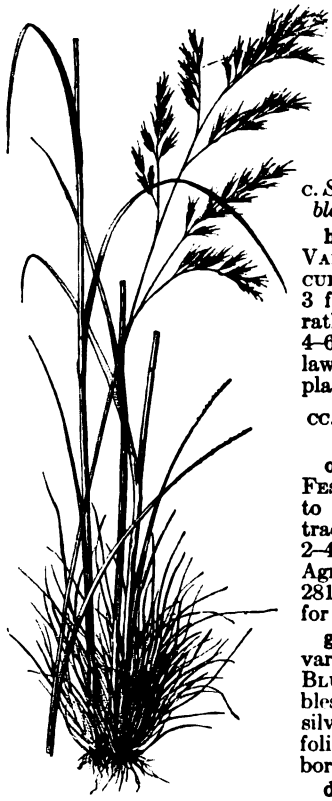
Blades narrow: infl. few-fld., paniculate; spikelets 2- to several-fld.; lemmas firm, rounded on the back, usually acute or awned from the tip.—Species about 100, in the temperate and cooler parts of the world.

A. *Spikelets awnless: blades flat, 2–4 lines wide.*

elàtior, Linn. TALL or MEADOW FESCUE. One to 3 ft.: spikelets 5–8-fld., about ½in. long. G. 8:179. Gn. 25, p. 428.—Frequently cult. as a meadow or pasture grass. The form called *F. praténsis* is rather smaller and has narrower panicles (Dept. Agric., Div. Agrost. 20:155), sometimes sold under the name *Bromus pratensis,* meadow brome-grass. Eu.

AA. *Spikelets awned: blades narrow involute.*

B. *Sts. loose and decumbent at base.*



1498. Festuca heterophylla. (×⅓)

rùbra, Linn. RED FESCUE. One-half to 2 ft.: base of sts. usually red. Eu.—Occasionally used in mixtures for pastures.

BB. *Sts. in close erect tufts.*

C. *St.-blades flat, the basal blades long and slender.*

heterophýlla, Lam. VARIOUS-LEAVED FESCUE. Fig. 1498. One to 3 feet., slender: panicle rather loose; spikelets 4–6-fld. Eu.—Cult. as a lawn grass in shady places.

CC. *St.- and basal blades involute.*

ovìna, Linn. SHEEP'S FESCUE. Fig. 1499. Six to 20 in.: panicle contracted after flowering, 2–4 in. long. Eu. Dept. Agric., Div. Agrost. 20: 281.—Sown in mixtures for pastures.

glaùca, Lam. (*F. ovìna* var. *glaùca,* Hack.). BLUE FESCUE. Resembles *F. ovina* but has silvery blue, or glaucous foliage. Eu.—Used for borders.

duriúscula, Linn. (*F. ovìna* var. *duriúscula,*

Koch). HARD FESCUE. Blades firm and comparatively thick, ½line diam., often rough. Eu.—Pasture mixtures.

vaginàta, Waldst. & Kit. (*F. amethýstina*, Hort., not Linn.). Sheaths and panicles purplish: foliage bluish: panicle 8 in. long. Eu.—Used for ornament.

A. S. HITCHCOCK.

FETTICUS. Another name for *Corn-Salad.*

FEVER-BUSH: *Benzoin.*

FEVERFEW: *Chrysanthemum Parthenium.*

FEVER-TREE: *Pinckneya pubens.*

FEVERWORT: *Triosteum.*

FIBER PLANTS are treated only incidentally in this work, and with particular reference to the horticultural values of the groups to which they belong. See Cyclo. Amer. Agric., Vol. II, p. 281.

FÍCUS (ancient Latin name). *Moràceæ.* The fig, the India rubber plant, the banyan tree and the creeping fig of conservatory walls belong to this vast and natural genus, which has over 600 species scattered through the warmer regions of the world.

Ficus has no near ally of garden value. It is a genus of trees or shrubs, often climbers, with milky juice. In the common fig the lvs. are deeply lobed, but in most of the other species they are entire or else the margin is wavy or has a few teeth or an occasional small lobe. The lvs. are nearly always alternate, *F. hispida* being the only species of those described below which has opposite lvs. The foliage in Ficus varies from leathery to membranous, and is variable in venation, so the veins are very helpful in telling the species apart. Ficus is monœcious or rarely dicœcious, the apetalous or sometimes naked minute fls. being borne inside a hollow more or less closed receptacle; stamens 1–3, with short and united filaments; pistillate fls. with 1-celled sessile ovary, ripening into an achene that is buried in the receptacle. What the horticulturist calls the fig, or fruit, is the fleshy receptacle, while the fruit of the botanist is the seed inside (Fig. 1500). In the following account, fruit is used instead of receptacle.

The fertilization or caprification of the fig is one of the most interesting and complicated chapters in natural history, and is of great practical importance. See *Fig*, where the culture of *F. Carica* is discussed.

The most important ornamental plant in the genus is the India rubber plant (*F. elastica*), which ranks amongst the most popular foliage plants for home use indoors. This is not the most important rubber-producing plant, both *Hevea brasiliensis* and *Castilla elastica* being producers of more and finer rubber.

The creeping fig (*F. pumila*, better known as *F. repens* or *F. stipulata*) is one of the commonest and best climbers for covering conservatory walls. It clings close and makes a dense mat of foliage, which is about as dark in color as the English ivy. The plant has been cultivated since 1771, but within the last half-century has come to be recognized as the best plant for its special purpose. Once in a long while it fruits in conservatories, and the fruiting branches are very unlike the barren ones. They stand out from the conservatory wall instead of lying flat and close. The leaves of the barren branches are less than an inch long and heart-shaped, with one side longer than the other at the base and a very short petiole; the leaves of fruiting branches are 2 to 3 inches long, elliptic-oblong, narrowed at the base, and with a petiole sometimes ½ inch long (Fig. 1501).

Among the many wonders of the genus Ficus are the epiphytal habit of some, the huge spread of the banyan tree (*F. benghalensis*), and the fact that some species ripen their fruits under ground. Some of the tallest tropical trees are members of this genus, and often they begin life by climbing upon other trees. The ficus often overtops and outlives the other tree, which may be seen in every stage of decay, or may have entirely disappeared, leaving the giant climber twined spirally around a great hollow cylinder. The banyan tree sends down some of its branches (or aërial roots) into the soil, these take root, make new trunks, and eventually produce a great forest, in which it is impossible to tell the original trunk. The banyan in the botanic gardens at Calcutta sprang from a seed probably dropped by a passing bird into the crown of a date palm a little more than a century ago. The main trunk not many years ago, was 42 feet in circumference, with 232 additional trunks, many of them 8 to 10 feet in circumference, and the branches extend over an area 850 feet in circumference, forming a dense evergreen canopy through which sunlight never penetrates. The banyan under which Alexander camped, and which is said to have sheltered 7,000 men, now measures 2,000 ft. in circumference and has 3,000 trunks. Other species have the same method of propagation, but *F. benghalensis* is the most famous.

1499. Festuca ovina. (×⅓)

The various species are cultivated both indoors northward and as shade and fruit trees in Florida and California. In this country the most important commercially is the fig, *Ficus Carica*, now widely grown in California. For the botanical treatment of this difficult genus recourse has been had to King's "The species of the Indo-Malayan and Chinese countries" in Ann. Bot. Gard. Calcutta 1:185 pp. + 232 plates, 1888, and wherever possible below reference is made to the splendid illustrations of that work, thus, K. 130.= King, plate 130. For the African species the recent treatment of Mildbraed and Burret on Die afrikanischen Arten der Gattung Ficus. Engler's Bot. Jahrb. 46:163–269 (1911), has been consulted.

The cultivation of Ficus elastica. (H. A. Siebrecht.)

The rubber plant (*Ficus elastica*) which is known all over this country, is perhaps the most popular and satisfactory house plant that has ever been cultivated. It is a plant for the million. Some florists have several houses especially devoted to the propagation and cultivation of this tough and thrifty plant. There are also thousands upon thousands of young plants or rooted cuttings from thumb-pots imported into this country, especially from Belgium and Holland, for marketing every spring. It is estimated that from 80,000 to 100,000 rubber plants are sold in America in a single year. There are several varieties of the rubber plant, but the true *Ficus elastica* is the best, both for growing and for selling. It can be easily told from the smaller-leaved variety, which is smaller and lighter colored in all its parts, the stem being smoother, and the sheath that covers the young leaves lacking the brown tint, which often runs into a bright Indian red.

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The method of propagating now popular in America employs old bushy stock-plants, either in pots or tubs, or planted out into a bed where the night temperature can be kept from 60° to 75° F. As soon as the young shoots are 5 to 6 inches long they are operated upon. An incision is made at the place where it is intended to root the young plant, cutting upward on a slant midway between two eyes, making the cut anywhere from 1 to 2 inches long, according to the thickness and length of the young shoot or branch. A small wedge, as a piece of match, is then inserted to keep the cut open. A large handful of clean, damp, well-prepared moss is then placed around the branch to cover the cut and is tied moderately firm with twine or raffia. Some use a small piece of charcoal for a wedge in the cut; others coat the two cuts with a mixture of charcoal dust and lime. The latter practice is beneficial in that it expedites the callusing of the cuts and the rooting of the young plant after being cut and mossed. The moss should be kept constantly moist, and the higher the temperature, within reasonable limits, the quicker the rooting process goes on. The roots of the young plant usually appear on the outside of the oval-shaped bunch of moss. A complete cut can then be made below the moss and the young plant potted. The smaller the pot at first the better. The leaves of the young plants should be tied up in order that they may not be injured by coming in contact with one another or by lying flat on the pots. The young plants now require a gentle bottom heat and frequent syringing,—a dozen times on clear days. As soon as the young plants are taken from the stock-plant, a little wax should be put on the end of the cut to prevent the milky sap from escaping. The best time of the year to propagate and root ficus is from the first of January to May. The European growers never start much before the Christmas holidays; and from then until spring they make all their cuttings.

The older method of propagating rubber plants is still the favorite one abroad; it employs single-eye cuttings. Sometimes, if the branches are very thick, only one-half the stem is taken with the eye and a single leaf, the leaf being curled up and tied with raffia, and the small piece with the eye set into the propagating-bed. This is a bed of sharp sand, or sometimes of sand and chopped sphagnum moss or fine cocoa-fiber. Frequently the single-eye cuttings are put at once into the smallest-sized thumb-pot, with a mixture of very finely ground pot-sherd and charcoal filling about one-half the pot, and either soil or sand for the remainder. A small stick is used to hold the leaf upright. These pots are plunged into the propagating-benches in either sand, moss or fiber, and a steady bottom heat of 75° to 80° is applied and kept up until the plants are rooted. As a rule, such beds are inclosed in a glasshouse, in order to keep about them a close, warm and moist atmosphere. Only ventilation enough to permit the moisture caused by the evaporation to escape is allowed on these beds. In this country, propagation by the first described method can be continued nearly all the year round. From experience of both methods, the writer can say that the top-cutting and mossing process is better by far, especially where plenty of stock plants can be maintained.

1500. Young figs. Showing how they arise from the axis of the leaves.

After being shifted from the smaller-sized pots into 3- or 4-inch pots, the young plants will stand a great deal of liquid manure as soon as they are rooted through or become somewhat pot-bound. Many propagators plant out the young plants from 3- and 4-inch pots into coldframes after the middle of May, or when all danger of night frost is past. They do very well in the bright, hot, open sun, but must receive plenty of water. After being planted out in frames, they should be potted not later than September, and for early marketing as early as August. The plan of planting out and potting in the later part of summer or early autumn is a very practicable one, as the plants do not suffer so much from the severe heat during the summer.

INDEX.

altissima, 28.
aurea, 12, 30.
australis, 26.
Barteri, 9.
Bellingeri, 27.
benghalensis, 32.
Benjamina, 13.
brevifolia, 16.
Carica, 1.
comosa, 13.
Cunninghamii, 23.
diversifolia, 18.
Duvivieri, 12.
elastica, 12, 26.
erecta, 17.
glabella, 15.
glomerata, 25.
heterophylla, 11.
hispida, 6.
humilis, 11.
indica, 31.
infectoria, 22.
Krishnæ, 8.
lutescens, 18.
macrocarpa, 3.
macrophylla, 19.
minima, 4.
nitida, 29.
oppositifolia, 6.
Palmeri, 21.
pandurata, 10.
Parcellii, 7.
populnea, 16.
Pseudo-Carica, 2.
pumila, 4.
quercifolia, 11.
radicans, 5.
religiosa, 14.
repens, 4.
retusa, 29.
Roxburghii, 24.
rubiginosa, 26.
Sieboldii, 17.
stipulata, 4.
variegata, 5, 12.
villosa, 20.

KEY TO THE SPECIES.

A. *Fr. large, edible: lvs. deeply lobed, deciduous for at least 5 months: plants almost hardy from N. Y. southward.*
B. *Lvs. wavy-margined or lobed*..... 1. **Carica**
BB. *Lvs. deeply lobed: fr. roughish*..... 2. **Pseudo-**
AA. *Fr. not usually edible, at least not as the fig is edible: lvs. entire or toothed, but not deeply lobed and not deciduous for such a long time: plants, with exception of F. macrophylla, not hardy, and cult. in greenhouses or outdoors in frostless areas of Fla. and Calif.* **[Carica**
B. *Habit climbing or trailing, often clinging to walls.*
C. *Plant a climbing shrub or tree: lvs. about 5 in. long*..... 3. **macro-**
CC. *Plant a creeping vine: lvs. less than 4 in. long.* **[carpa**
D. *Lvs. unequally heart-shaped at base*... 4. **pumila**
DD. *Lvs. only slightly notched at base*..... 5. **radicans**
BB. *Habit erect or straggling, shrubs or trees; not climbing or trailing.*
C. *Lvs. usually opposite*..... 6. **hispida**
CC. *Lvs. always alternate.*
D. *Foliage variegated*..... 7. **Parcellii**
DD. *Foliage not variegated, except in a variety of F. elastica.*
E. *The lvs. cup-shaped*..... 8. **Krishnæ**
EE. *The lvs. not cup-shaped.*
F. *Length of lvs. more than 4 times the breadth*..... 9. **Barteri**
FF. *Length of lvs. less than 3 times the breadth.*
G. *Form of lvs. fiddle-shaped or banjo-shaped, very large*.....10. **pandu-**
GG. *Form of lvs. not as above.* **[rata**
H. *Lvs. lobed, much as in the native oaks: a shrub*.....11. **querci-**
HH. *Lvs. not so lobed.* **[folia**
I. *Primary lateral nerves more than 8 pairs, usually much more.*
J. *The primary lateral nerves 50 pairs or more*.....12. **elastica**
K. *Sheath rosy, showy: lvs. 4–12 in. long*.....13. **Benja-**
KK. *Sheath inconspicuous: lvs. 2–4½ in. long.* **[mina**
JJ. *The primary lateral nerves less than 50 pairs.*
K. *Color of fr. purplish.*
L. *Tree 100 ft. or less: lvs. very long-acuminate*....14. **religiosa**
LL. *Tree small: lvs. short-acuminate*.....15. **glabella**
KK. *Color of fr. not purplish.*

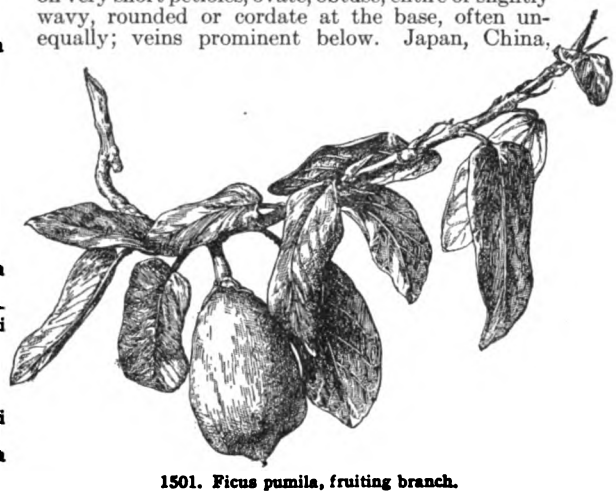
L. *Fr. globose and stalked*..16. **brevi-**
LL. *Fr. if stalked, pear-shaped, often nearly sessile*.....17. **erecta**
II. *Primary lateral nerves less than 8 pairs.*
J. *The primary veins distinctly bifurcating*.....18. **diversi-**
JJ. *The primary veins not bifurcating* **[folia**
K. *Stipular sheaths large and showy, rosy*.....19. **macro-**
KK. *Stipular sheaths not large and showy.* **[phylla**
L. *Whole plant brown-hairy*.20. **villosa**
LL. *Whole plant not brown-hairy: lvs. often hairy or villous.*
M. *Frs. white or whitish.*
N. *Young lvs. densely woolly beneath; mature lvs. not abruptly acuminate*.....21. **Palmeri**
NN. *Young lvs. not densely woolly; mature lvs. abruptly acuminate*.22. **infec-** **[toria**
23. **Cunning-**
MM. *Frs. red or yellowish.* **[hamii**
N. *The frs. on scaly leafless branches.*
O. *Lvs. almost orbicular*.....24. **Rox-**
OO. *Lvs. ovate to ovate-lanceolate*.....25. **glomer-** **[burghii**
NN. *The frs. sessile or short-stalked.* **[ata**
O. *Young lvs. woolly or rusty.*
P. *Lvs. cordate at base.*
Q. *Diam. of fr. about ½in.*.....26. **rubigi-**
QQ. *Diam. of fr. 1¼-1½ in.*.....27. **Bellin-** **[nosa**
PP. *Lvs. not cordate at base*.....28. **altissima** **[geri**
OO. *Young lvs. not woolly or rusty.*
P. *Base of lvs. narrowed.*
Q. *Stipules glabrous.*
R. *Lvs. 2–4 in. long: fr. yellow or reddish*....29. **retusa**
RR. *Lvs. 3–4½ in. long: fr. orange-yellow*.30. **aurea**
QQ. *Stipules not glabrous*.....31. **indica**
PP. *Base of lvs. rounded*.....32. **benghalensis** **[ensis**

1. **Cárica,** Linn. Figs. 1500, 1505, 1506. Height 15–30 ft.: lvs. 3–5-lobed, the lobes more or less wavy-margined or lobed, and with palmate veins, whereas nearly all species mentioned below are pinnately veined: fr. single, axillary, pear-shaped. Supposed to be a native of Caria, in Asia Minor.—Makes a fine pot-plant, and fruits freely in northern conservatories. For cult. see *Fig.*

2. **Pseúdo-Cárica,** Miq. Resembling the fig of commerce, but the lvs. more deeply cut than in *F. Carica*, 3- or sometimes 5-nerved: fr. axillary, round, roughish. Abyssinia.—Franceschi says of the Calif. cult. specimens "fr. said to contain very much sugar, but so far (1914) it has never come to perfection in Calif., where, however, it is now attracting considerable attention, it having proved to be the very best home for. . . . small wasps (Blastophaga) which are indispensable for the fertilization of the so-called 'Smyrna figs'."

3. **macrocárpa,** Wight. Becomes a large, climbing shrub, very rarely a small tree: lvs. 5 in. long, membranous, broadly ovate; petiole 2–2½ in. long; primary lateral nerves about 3 pairs: fr. 1–2½ in. thick, spotted, globose, in cauline clusters. India. K. 208.—This name was once advertised as a shrub with leathery lvs. The true species is a climbing shrub.

4. **púmila,** Linn. (*F. stipulàta*, Thunb. *F. rèpens*, Hort., not Rottl.). CREEPING FIG. Fig. 1501. Prostrate or climbing shrub, clinging close to conservatory walls and then flattened: lvs. more or less 2-ranked, on very short petioles, ovate, obtuse, entire or slightly wavy, rounded or cordate at the base, often unequally; veins prominent below. Japan, China, Austral. B.M. 6657. R.H. 1891:448. K. 158. G.C. II. 14:560, 561, 717. H.U. 4, p. 359 (the last two as *F. stipulata*). Var. **mínima** (*F. mínima*, Hort.) has smaller lvs. The species is sometimes used for hanging-baskets.



1501. Ficus pumila, fruiting branch.

5. **radícans,** Desf. Garden plant, with green, oblong-acuminate lvs. and trailing habit. Imperfectly known. Habitat unknown. Var. **variegàta,** Hort. W. Bull., has lvs. irregularly marked with creamy white, the variegation beginning at the margin. G.C. III. 22:185. A.G. 19:527. R.B. 28:37.—Useful for hanging-baskets. Intro. 1897.

6. **híspida,** Linn. f. (*F. oppositifòlia*, Willd.). Shrub or small tree, all the parts mostly hispid-pubescent: lvs. entire or toothed, opposite, rough-hairy: fr. clustered on old wood or leafy branches, hispid, yellowish. Asia, Trop. Austral. K. 154, 155.—Scarcely cult. in Amer. outside of botanic gardens.

7. **Parcéllii,** Veitch. Lvs. thin, membranous, light green, mottled with cream-white, more or less in the manner of mosaic, oblong-oval, acuminate, dentate. Islands of Pacific. F.S. 22:2273. F.M. 1874:124. A.F. 29:1290. G.C. III. 35:13.—Intro. by Veitch about 1874. A warmhouse shrubby plant; probably the most popular of the variegated forms of Ficus. Readily prop. by cuttings of half-ripened wood placed in sand in brisk bottom heat. Also cult. in S. Calif., where it bears tricolored fr.

8. **Krishnæ,** DC. KRISHNA BOR. Small tree with gray bark, the branches puberulent: lvs. cup-shaped, the limb of the cup containing the mid-rib, with 4–5 pairs of lateral nerves: fr. axillary, sessile, solitary or sometimes in pairs, yellow, about ½in. diam. India. B.M. 8092, where there is also an account of the superstitions in regard to the tree among the Indians.—The large showy and extraordinarily cupped lvs. of this most distinct fig will undoubtedly make it popular. Little known as yet in U. S.

9. **Bárteri,** Sprague. A shrub or small tree 6–25 ft. tall in nature, lower in cult., smooth, with thick ridged branches: lvs. petiolate, the blade the narrowest of almost all the figs, 6–14 in. long, and less than 1½ in. wide, bright green above, paler beneath; primary lateral

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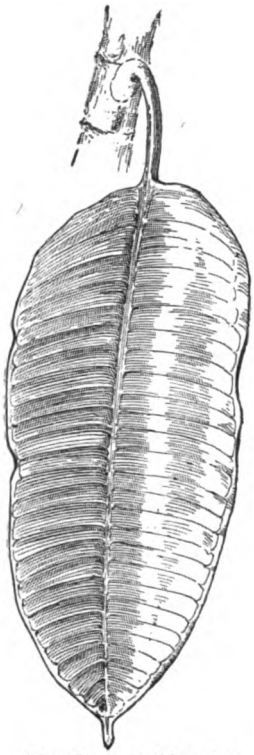
nerves 16–18 pairs: frs. in axillary clusters of 2–3, almost round, orange-colored when mature, and edible. S. Nigeria.—Little known in U. S. as yet, but worthy of cult.

10. **panduràta,** Hort., not Hance, which is an acuminate-lvd. Chinese fig, apparently not in cult. A showy shrub or tree with distinctive fiddle-shaped or banjo-shaped lvs. frequently a foot long, decidedly emarginate at the apex, cordate at the narrowed base, dark glossy green, the prominent nerves whitish: fr. unknown. G. 28:682. G.C. III. 33:284. Gng. 16:34. Gn. M. 8:268. A.F. 23:239; 26:203.—A showy stove fig now widely grown. Intro. in 1903.

11. **quercifòlia,** Roxbg. The oak-lvd. form is the typical one, but King includes *F. humilis*, Roxbg., in which the lvs. are serrate or nearly entire and not lobed. Lvs. 2–5 in. long, "thickly membranous;" nerves 5–7 pairs; petiole ½–1 in. long: fr. in axillary pairs, egg- or pea-shaped. Burma, Malaya, where it is a shrub. L.B.C. 16:1540. K. 95. (The plant fruiting soon after importation, when 2 ft. high.)—Advertised in 1895, and grown for years at the Montarioso Nurseries. Voss refers this, with many other synonyms, to *F. heterophylla*.



1502. Leaf of rubber plant, Ficus elastica, showing venation. (×¼)

12. **elástica,** Roxbg. (*F. Duvivièri*, Hort., a form with thinner lvs.; otherwise the same). India Rubber Plant. Figs. 1502, 1503. Lvs. 4–12 in. long, shining, leathery, oblong to elliptic, with an abrupt, dull point; nerves parallel, running at nearly right angles from midrib to margin: fr. in pairs, sessile, in axils of fallen lvs., covered at first by a hodded involucre, when ripe greenish yellow, ½in. long. Damp forests of Trop. Asia. G.F. 2:547. H.U. 6, p. 108. K. 54.—Becomes 100 ft. high in tropics, but becomes unsightly under glass at 8 or 10 ft. Cult. plants mostly have a single st., but there is a growing demand for compact and branching plants. Var. **variegàta** (var. *aùrea*, Hort.) is much less popular. Lvs. creamy white or yellow near the edges. Liable to fungous diseases. This species is also grown S. as a shade tree. The nervation is very characteristic. So, also, is the handsome rosy sheath which incloses the young lvs., and which soon drops off. This is regarded as a stipule of exceptionally great size.

13. **Benjamìna,** Linn. A rather unimportant tree horticulturally, with small lvs., and smooth throughout: lvs. thin, not much coriaceous, shining, ovate-elliptic, entire, the apex sharply acuminate, 2–4½ in. long; lateral primary nerves very numerous, freely intermingling near the margins of the lvs.: frs. in pairs, axillary and sessile, smooth and blood-red when ripe. Malayan Penins. K. 52, 83*h*. Var. **comòsa,** Kurz. Fig. 1504. Sepals lanceolate-acuminate rather than spatulate: fr. ¾ in. diam., narrowed at base rather than globose or ovoid.

14. **religiòsa,** Linn. P[illegible] of the Hindoos. Lvs. ovate-rotund, at t[illegible] duced into a long, linear-lanceolate tail-lik[illegible] petiole 3–4 in. long; stipules minute: fr [illegible] pairs, sessile, dark purple, ½in. thick. In[illegible] 435. K. 67*a*.—Grows 100 ft. high, and [illegible] suspended on their long, flexible petioles, [illegible] the slightest breeze. "Quite hardy in S. Cali[illegible] attaining very large size."—Franceschi.

15. **glabélla,** Blume. A [illegible] ultimately glabrous throughout: lvs. petioled, thin, not very leathery, obovate-oblong, acuminate, entire, 2–4 in. long, 3-nerved, and with 8–10 pairs of primary lateral nerves: fr. all lateral, sometimes axillary, usually not so, sessile, or very rarely stalked in cult. specimens, dark purplish, sometimes with yellow dots, less than ½in. diam. Malaya Penins. K. 60.

16. **brevifòlia,** Nutt. (*F. popúlnea*, Willd.). An evergreen tree, sometimes epiphytic in nature, 10–30 ft.: lvs. thin and only slightly leathery, ovate or rarely obovate, 1½–4 in. long, acute at the apex, broad at the base; primary lateral nerves 14–16 pairs: fr. distinctly stalked, yellow when young, ultimately bright red, about ½in. diam., and nearly globose. Fla.—Of little value horticulturally, except for the frs.

17. **erécta,** Thunb. Extraordinarily variable: shrub to small tree, glabrous, pubescent, or almost strigose: lvs. broadly ovate, obovate or elliptic (lanceolate in var. *Sieboldii*), entire or with here and there a lobe, or rather coarsely dentate above the middle: fr. single or in pairs, peduncled or subsessile, and either globose and not stalked or pear-shaped and long-stalked. Himalayas, China, Japan. B. M. 7550 (where the lvs. look rather leathery). K. 178.—Procurable through dealers in Japanese plants.

1503. Ficus elastica, the rubber plant of florists.

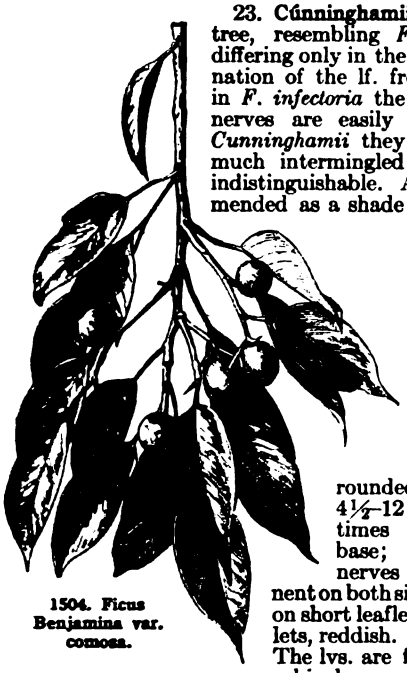
18. **diversifòlia,** Blume (*F. lutéscens*, Hort.). Mistletoe Fig. A smooth shrub or small tree with short-stalked or sessile lvs.: lvs. broadly obovate, the much-narrowed base glandular, 1–3 in. long, midrib branched once or twice, glandular at the joints: fr. axillary, solitary, or rarely in pairs, always stalked, dull yellow or reddish when ripe. India and Malay Penins. R.B. 30:156. K. 174.—The small lvs. and usually solitary fr. suggest the mistletoe, and in nature the plant is often an epiphyte.

19. **macrophýlla,** Desf. Moreton Bay Fig. Lvs. 6–10 in. long, 3–4 in. wide; stipules 2–4 in. long: fr. nearly globular, 9–12 lines thick, axillary, in 3's or 4's, on short, thick peduncles. Austral.—Much planted in S. and Cent. Calif., where, however, it do[illegible] seed. F. von Mueller says it is perhaps [illegible] of Australian avenue trees. Ernest Br[illegible] for this species partial or perhaps comple[illegible] from frost. He cites a specimen in Cal[illegible] out after a heavy frost and is still (19[illegible] more than a year has elapsed since the

20. **villòsa,** Blume. A straggling shrub, the whole plant brown-hairy: lvs. thick and leathery, petioled, oblong-ovate, sharply acuminate, the base cordate, 3–5-nerved at the base, the primary lateral nerves 5–6 pairs, 5–6 in. long: fr. short-stalked, in axillary clusters. Malaya. K. 172.—A good stove climber, but little known in Amer.

21. **Pálmeri,** Wats. Tree, 8–12 ft. high, branching near the ground: lvs. 3 in. long, 2–2½ in. wide; petiole 1 in. long: fr. in pairs, axillary, globose, ½in. thick, white, according to Franceschi needing much heat to develop. Discovered on San Pedro Martin Isl., N. W. Mex., 1887.—Perhaps the best adapted to severely hot and dry places. Franceschi says it attains 30 ft.

22. **infectòria,** Roxbg. A low tree, all the parts smooth; often deciduous for some weeks at a time: lvs. 3½–5 in. long; nerves 5–7 pairs, not prominent: fr. in axillary pairs, sessile, globose, ¼in. thick, whitish, flushed and dotted. Trop. Asia, Malaya. K. 76–79. —Grows 60 ft. high, and is one of the best shade trees.



1504. Ficus Benjamina var. comosa.

23. **Cúnninghamii,** Miq. A large tree, resembling *F. infectoria* and differing only in the form and acumination of the lf. from that species: in *F. infectoria* the primary lateral nerves are easily detected; in *F. Cunninghamii* they are fine and so much intermingled as to be almost indistinguishable. Austral.—Recommended as a shade tree for extreme S. Fla. by Reasoner Bros. Cult. in temperate house northward. Deciduous for several months each year.

24. **Róxburghii,** Wall. A low tree, 10–20 ft.: lvs. broadly-ovate or rounded, 5–15 in. long, 4½–12 in. broad, sometimes cordate at the base; primary lateral nerves 5–7 pairs, prominent on both sides: fr. 2 in. diam. on short leafless cauline branchlets, reddish. India. K. 211.—The lvs. are frequently almost orbicular; very ornamental.

25. **glomeràta,** Roxbg. Cluster Fig. Lvs. 4–7 in. long; nerves 4–6 pairs: fr. clustered on leafless, scaly branches, pear- or top-shaped, 1¼ in. thick, reddish. India, Burma. K. 218, 219.—"A quick-growing, evergreen shade tree."—Reasoner. "A dense shade tree: lvs. have a peculiar metallic luster and are deciduous for a short time at the end of winter: small frs., much relished by cattle and children but dry and woody." —Franceschi.

26. **rubiginòsa,** Desf. (*F. austràlis,* Willd.). Lvs. leathery, rounded or cordate at base, notched at tip: fr. mostly in pairs, globular, 5–6 lines thick, usually warty. Austral., where it throws out aërial roots like the banyan tree. B.M. 2939.—The rusty color is a beautiful feature. Voss considers this a form of *F. elastica.*

27. **Béllingeri,** C. Moore. Tall glabrous tree: lvs. ovate, sharp-pointed, leathery, 5–6 in. long, dark green and shining above, light green and paler underneath; petioles 2–3 in. long: fr. 1¼–1¾ in. diam., marked with small scattered warts. New S. Wales.—According to Franceschi it grows faster than *F. rubiginosa,* its nearest relative. Rare in cult., but advertised in 1914.

28. **altíssima,** Blume. A tall tree with only a few aërial roots, when mature wholly glabrous: lvs. petiolate, thick and leathery, broadly ovate, sometimes inequilateral, but not cordate, shining, 3–5-nerved and with 5–6 pairs of lateral primary nerves, 4–7 in. long: fr. axillary, sessile, in pairs, yellowish when ripe. India. K. 30, 30*a*.—Said by an American dealer to resemble *F. pandurata,* but this must be an error. Franceschi says it is taller-growing and finer than *F. elastica.*

29. **retùsa,** Linn. (*F. nítida,* Thunb., and Hort., not Blume). Lvs. 2–4 in. long; nerves 5 or 6 pairs; petiole 3–6 lines long: fr. sessile, in pairs, axillary, 4 lines thick, yellow or reddish. Trop. Asia, Malaya. K. 61, 62.—A large evergreen tree with a few aërial roots.

30. **aùrea,** Nutt. Branches pale, smooth, furrowed: lvs. 3–4 in. long, smooth, oblong, entire, narrowed but obtuse at each end, stout-petioled: fr. orange-yellow, globose, 4 lines thick. S. Fla.—Reasoner says it is a handsome decorative plant for the florist, and that it grows 60 ft. high. Chapman describes it as a small tree; he says nothing about stipules. Too tender for outdoor cult. in S. Calif.

31. **índica,** Linn. Not the banyan tree. Glabrous throughout, except stipules: lvs. 4–7 in. long; nerves about 4–6 pairs, not very prominent; petiole 4–12 lines long; stipules 6–9 lines long: fr. in crowded pairs, sessile, globose, smooth, yellowish red, 4 lines thick. Trop. Asia, Malaya. K. 45.—This species is greatly confused in botanical literature with *F. benghalensis,* but *F. indica* does not take root from its branches, as does the banyan tree. In recent writings, *F. indica* is often given as a synonym of *F. benghalensis,* but the distinctions here given are those made by King, in Flora Brit. India 5:499 (1890). Tree grows 50 ft. high.

32. **benghalénsis,** Linn. Banyan Tree. Also written *bengalensis.* Young parts softly pubescent: nerves prominent; petiole 6–18 lines long; stipules 9–12 lines long: fr. in pairs, sessile, globose, puberulous, red, about the size of a small cherry. Trop. Afr., India.—A tree, 70–100 ft. high, rooting from the branches, thus forming accessory trunks and extending the growth of the tree indefinitely. For an explanation of the confusion between *F. benghalensis* and *F. indica,* see Hooker's Flora Brit. India 5:499, 500. K. 13.—There are vigorous specimens growing outdoors at Miami, Fla.

F. Afzélii, Don, is a plant from S. Afr., never described by Don. The plant in the trade is said to be F. eriobotroides. Once advertised for indoor ornament.—*F. carnòsa,* Hort. Advertised 1895 for indoors.—*F. Chauvièrii,* Hort. In Eu. this is said to be second only to F. elastica. Franceschi says it has broader and more oval lvs., large red figs, not edible, and comes from New Caledonia, where it attains 60 ft. J. D. Eisele says that it has oval lvs. with creamy white veins, is strong-growing, and should be valuable for subtropical gardening. The name is unknown in botanical literature. A plant cult. at N. Y. Bot. Gard. as this species has orange fr.—*F. Coòperi,* Hort., is cult. indoors from Trop. Amer. Advertised 1895. The name is unknown in botanical literature. G. 1:757.—*F. Dryepóndtia,* Hort., is a striking shrub with long-stalked lvs. that are silvery green above and dark purple beneath. Probably not a Ficus. R. B. 32, p. 85. Said to be a native of Afr.—*F. eetveldiàna,* Hort., is a species "with large broadly oval lvs. and with the veins and nerves colored," something as in Caladium. The name is unknown in botanical literature. G.C. III. 28:303.—*F. eriobotroides,* Kunth & Bouché. Habitat unknown. See F. Afzelii.—*F. falcàta,* Miq., is cult. but not advertised. A creeper, with lvs. often of 2 forms, leathery, tesselately dotted and colored beneath. It is a form of F. punctata, with lvs. oblong or subrhomboid, obtuse, not tapering below. India.—*F. Lucidnii,* Hort., "has large lvs." Intro. 1900. Otherwise unknown.—*F. lùcida,* Dry. From India, but not described in Flora of British India. Advertised 1893 for indoors.—*F. maculàta,* Linn., described by Franceschi (1914) as with lvs. "large, oval, light green, not glossy. Cochin-China." must be some other plant than the true F. maculata, which is a serrate-lvd. fig from Santo Domingo.—*F. nemoràlis,* Wall., is a "small tree or bush" with smooth, petioled lvs. which are 3-nerved and dark-colored beneath: fr. smooth axillary, about ½in. diam. India. K. 206, 207.—There are many forms.—*F. princeps,* Kunth & Bouché. Brazil. Cult. by Franceschi, who says it grows 60 ft. high and has magnificent foliage, which is bronze and copper-colored when young.—*F. pyrifòlia* may be F. Benjamina, F. erecta, F. Fontanesii, or F. rubra. The name is advertised by Yokohama Nursery Co., who also advertise F. erecta.—*F. rugòsa* is a trade name for some fig as yet undeterminable. The true F. rugosa, Don, is perhaps a Trop. African species, but was not characterized by Don, and the status of the name is uncertain.—*F. Syco-*

mórus, Linn. (Sycomorus antiquorum, Gasp.), is a tree with petioled, ovate, entire 8–10-ribbed lvs. which are deciduous for some months each year: fls. greenish or yellowish in pedunculate racemes: fr. small but abundant, extensively used for food: it is a branching tree 30–40 ft. high, the lvs. smaller than those of the fig, more or less angular or even lobed. Egypt and Syria; the sycamore of the Bible; Pharaoh's fig. Intro. in U. S., but not in the trade.—*F. vásta*, Hort.=F. populifolia, an Abyssinian species not in cult.—*F. Wéndlandii* has lvs. "10–12 in. long by 8–10 in. wide, of a dark green color, and light green ribs and veins." Its habitat and fr. are unknown.—*F. Wrightii*, Benth., a creeping or climbing fig not cult. in Amer. outside of fanciers' collections: lvs. 3–4 in. long, wedge-shaped, 3-nerved. Probably=F. foveolata, Wall. China.

N. TAYLOR.†

FIG (Plate XLII) is *Ficus Carica*, a native of Asia. It is a warm-temperate fruit, although it will stand 10° to 20° of frost under favorable conditions. It was early introduced into North America, but until recent years it has been little grown commercially. It has been known to fruit in the open in Michigan without other protection than a high board fence inclosure, but usually, if grown north of Philadelphia, the plants are lifted in early November, with good balls of earth, kept in a dryish cellar over winter, and planted out the next spring. From Philadelphia to the Carolinas it may be bent to the ground and covered with earth or pine boughs. The fruit is borne on the young wood, and often on young trees. This fruit is really a hollow pear-shaped receptacle with many minute seeds (botanically fruits) on the inside; it grows like a branch from the side of the shoot. Inferior, run-wild forms are frequent in the southern states, where they are sometimes called "old man and woman" by the negroes. Figs may be grown under glass, being planted permanently in a border after the manner of hothouse grapes. They usually bear better if the branches are trained more or less horizontally. Two or more crops may be expected in one year under glass. Eastern nurserymen sell fig trees. As early as 1833 Kenrick ("New American Orchardist") described 23 varieties. Popular varieties for amateur cultivation in the East are Turkey, White Genoa, Black Ischia and Celeste. In order to facilitate the ripening of the fruit in cool climates or under glass, it is a custom to dress the surface of the nearly full-grown figs with sweet oil. As a dessert fruit figs are usually eaten in the fresh state, in which condition they are scarcely known to people in cool climates. They are also cooked, and preserved. The commerical fig is the dried fruit.

The fig is propagated very easily from hardwood cuttings, as grapes are. Take cuttings in the fall, removing just below a bud. If wood is scarce, single-eye cuttings may be used, being started preferably in a frame. From cuttings, bearing plants may be expected in two to four years. New varieties are obtained from seeds.

Various fruit books give directions for the growing of figs. Publications in California and of the United States Department of Agriculture discuss them. But the only independent American writing seems to be James T. Worthington's "Manual of Fig-Culture in the Northern and Middle States," Chillicothe, Ohio, 1869. Although regularly copyrighted, it is a pamphlet of only ten pages. It recommends the laying down of the trees in late fall and covering them with earth. This practice gave better results than covering with other material, or carrying the trees over winter in cellars, either in tubs or transplanted from the open (p. 1552). L. H. B.

Figs in the southeastern and Gulf states.

In the southeastern Atlantic and Gulf states the fig has been cultivated since the days of the earliest settlements. The exact time of introduction and indeed the exact origin of many of the more important varieties are unknown. For many years the trees, or more properly bushes, found a place as dooryard or garden plants, and to this day some of the finest specimens are to be found near the shelter of buildings in country, town or village. The fruit was used by the owners of the bushes and the surplus found its way into the local market.

Within the last ten to twenty years, attention has been given to the fig as a commercial fruit and it has found a place as an orchard fruit in many localities. Its culture may be said to extend from Norfolk, Virginia, southward along the Atlantic coast, and around the Gulf of Mexico into Texas. In proximity to the water it is grown without protection, but inland, particularly in the northern limits of its range, the bushes are protected during the winter months, by bending them down and covering with boards, straw, heavy paper, in fact anything that will cover them. With some care in protecting the plants by laying them down and covering in winter, the fig is grown beyond the region in which it has a place as an orchard fruit. Most of the orchard plantings have been made in close proximity to the ocean or gulf.

The propagation of the fig in this region is almost entirely by cuttings made from well-ripened wood and planted during winter or in early spring. The hardened wood from old bearing trees gives the most satisfactory results. The cuttings should be 4 to 5 inches long, and cut through the nodes. In planting, the cuttings are set with the upper ends level with the surface of the earth.

Soils best adapted to the growing of the fig are clay soils, or heavy soils, which are or may be kept uniformly moist. No greater mistake can be made than to attempt the culture of the fig in light sandy soils, more or less deficient in moisture in the lower South. Under these conditions, the nematode (root-knot) works serious damage to the roots of the trees and the planting soon dies out. But on heavy soils, the nematodes are not able to work such havoc and the fig thrives in spite of their limited attacks. On light soils, the fig may be grown in the well-packed earth of yards or planted against buildings where the roots may find their way into the soil beneath the buildings, where the nematode has been starved out for lack of food plants. The shaded condition of the soil is also beneficial. It is doubtful whether a successful planting can be made on any large scale on light soils in the lower South for the reasons just indicated

Varieties.

The varieties which may be grown successfully in the area indicated belong to the group which will carry good crops of fruit without pollination. On account of climatic conditions, it is doubtful whether figs of the class requiring caprification can ever be successfully grown.

The more important varieties are the following:

Black Ischia.—Size medium to large; color of skin bluish black, almost entirely covered with delicate bluish bloom; flesh creamy white; quality good. Strong grower, not a heavy bearer but quite hardy. Season late.

Brunswick.—Fruit very large, broadly pear-shaped with short, rather slender stalk; ribs well marked, eye large, open with rosy scales; skin tough, dark brown in color; pulp thick, pink, soft, quality fair. Midseason and late.

Celeste.—Small to medium, pear-shaped, ribbed; violet-colored, sometimes shading purplish brown, covered with bloom about half way up from the neck; stem short, stout; flesh whitish, shading to rose-color at center, firm, juicy, sweet, excellent quality. One of the hardiest varieties of figs, and can be grown far outside of the usual limits of culture; very desirable for canning and preserving. Season early.

White Ischia.—Fruit of medium size, turbinate; skin greenish yellow; pulp rosy, red, soft, melting; quality rich, sweet; a variety of high quality. Very productive. Season late.

Lemon.—Fruit medium to large, flattened, faintly

XLII. A young Celeste fig tree, as grown in Georgia.

ribbed, light yellowish green; stem short, stout; flesh white, sweet, rather soft; quality fair to good. Vigorous and prolific. Early.

Magnolia.—Fruit of large size; amber-colored; flesh pinkish amber, handsome. Vigorous grower; prolific; excellent for canning. Midseason and late.

Turkey (Brown Turkey).—Size medium to large; broadly pear-shaped, with short, thick stalk; ribs few in number; color coppery brown; flesh white, or slightly amber-colored, shading to pink about the seeds; flesh solid, excellent quality. It is very hardy and prolific. Midseason and late.

Of the varieties just described, the more important commercial sorts are Celeste, Turkey, Brunswick and Magnolia.

Magnolia is the favorite variety along the coast in Texas from Beaumont southward. In the eastern Atlantic states it is not so favorably regarded, as the fruit splits and sours on the trees during the rainy weather which so often comes when the crop is maturing. It is entirely distinct from the Turkey fig. Turkey or Brown Turkey is very hardy, of dwarf growth and therefore a favorite in the colder sections in which the trees must be protected during winter. Celeste equals Turkey in hardiness, but it is a more robust grower. It is the most commonly planted variety from Beaumont, Texas, eastward, and in the southeastern states should generally be given preference for orchard planting. Brunswick, on account of its large handsome appearance is a desirable variety for the production of fresh fruit for market.

General cultivation.

In setting the fig in orchard, the trees are commonly placed 10 by 15 feet or 12 by 20 feet in thoroughly plowed and pulverized soil. January and February in the lower South are favorite months for planting, but in the colder sections it is usually better to delay planting until after spring opens. While setting the trees, great care should be taken to prevent the roots from becoming dried out. This point must be strongly emphasized, as the character of fig roots is such that they will not stand drying.

It is not best to attempt to train the figs to tree form, but to allow them to develop with three or four trunks. To start them in bush form it is necessary to cut the plants back hard at time of planting. In case of severe weather during winter there is much less danger of losing whole trees if grown with several stems or trunks than if grown with single trunks. Subsequent pruning should be done to remove any sprouts or suckers that come up from the ground, to remove dead or injured branches, and to shape the form of the trees during the first few seasons. Branches that have to be removed for any cause should be cut back entirely rather than to stubs. The fig will not stand severe pruning year after year, such as has sometimes been attempted, and it is best to prune as little as possible to keep the trees in good shape.

As the fig is a shallow-rooted tree, deep tillage is impossible. The orchard should not be plowed and implements for shallow cultivation only should be used. There is no better tillage tool than an ordinary hoe, but its use is too expensive on large plantings. It may, however, be used in the garden plot. Cultivation should begin in spring just in advance of the starting of growth and should continue at weekly or ten-day intervals until about July 1. Cover-crops of cowpeas or beggarweed should then cover the ground until autumn. In the handling of plantings of the later-ripening sorts, cultivation should be continued later in the season, and a winter cover-crop used instead of a summer one. Stable manure and commercial fertilizer should be used liberally to supply the necessary plant-food.

A considerable amount of fruit can be and is handled in the markets as fresh fruit. It should be carefully cut from the trees early in the morning, selecting only well-colored but firm fruit, packed in strawberry carriers and shipped by express. When the work is properly handled in this way, its marketing presents no serious difficulties within a radius of 100 miles or so in the lower South and even greater distances in the northern area of its possible culture. By far the greater quantity of fruit is used by the canneries in the manufacture of preserved figs. A very delicious product is manufactured in the lower South, and meets with a ready sale.

H. Harold Hume.

The fig in California.

The fig, as grown in California at the present time, illustrates, perhaps more than any other fruit, the difficulties that arise in the course of the introduction of any new and highly specialized industry. Years of time and the united labors of many persons have at last resulted in the permanent establishment of fig-culture on a large scale in some parts of California. The successive steps by which this has been accomplished form one of the most remarkable chapters in our horticultural history.

1505. White Adriatic fig.

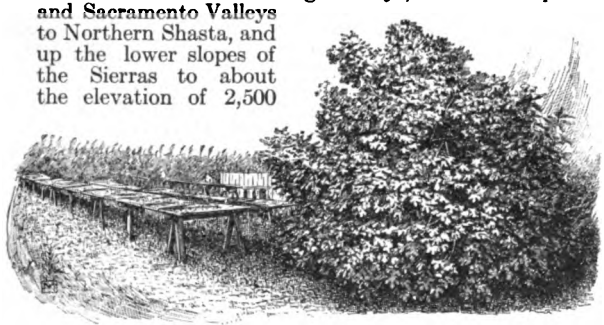
The edible cultivated fig is a native of southwestern Asia and undoubtedly ranks as one of the most ancient, beautiful and valuable of all fruit trees, forming a large part of the daily food of the people in those countries in which it thrives. The common name fig comes from *Ficus*, and that from the Hebrew "feg." The importation of figs, dried, canned or preserved, into regions unsuited to their growth, forms an immense and increasing group of industries. The literature of the fig, always very large, is receiving continual additions, as new varieties are introduced, as new values are found for the varied products and as its culture is being extended far beyond what were thought, twenty years ago, to be its inflexible climatic limitations.

The botanical varieties of the edible fig (*Ficus Carica*) as generally recognized include the following: (1) *Ficus Carica* var. *sylvestris*, the all-important wild fig of Asia Minor; (2) *Ficus Carica* var. *smyrniaca;* (3) *Ficus Carica* var. *hortensis;* (4) *Ficus Carica* var. *intermedia.*

The first of these, commonly known as the Capri fig, is not edible, but it was discovered ages ago that the famous little fig-wasp, formerly called *Blastophaga psenes* but now determined as *Blastophaga grossorum*, breeds within it and is able to cross-pollinate the flowers of the invaluable Smyrna fig which otherwise will not perfect fruit. This process is termed "caprification" and is absolutely necessary for the maintenance of the highest grades of commercial orchards. The third of these groups includes all the self-fertilizing table and preserving varieties of the common fig. The fourth variety (*intermedia*) has the ability to mature one crop without cross-pollination, but not a second. The best figs for drying are all of the second class (var. *smyrniaca*) and three crops are the usual thing in average seasons. In fact, nearly all the cultivated figs bear three more or less distinct crops; in many orchards and gardens of California one may gather ripe figs every day from late July until frost and rains destroy the very perishable fruits.

Figs have been cultivated on the Pacific coast for more than two centuries, as it is thought that they were in the Mission gardens at Loreto, Lower California, before 1710. Father Zephyrin's monumental "History of the Franciscan Missions in Calfornia," three volumes of which have now been issued (1913), contains many facts about the first Mission gardens from San Diego to Dolores and Sonoma. The fig was in them all, and was spoken of by the early visitors to California, such as Malaspina, Menzies, Mocino and Vancouver. Santa Clara Mission had rows of very large fig trees before 1792.

At the present time (1913), the fig has become established over almost the entire horticultural area of California, wherever the temperature does not fall below 18° F. It does not thrive where there is much fog or where the summers are cold and windy, but even in such places if somewhat protected by walls or buildings, it matures fruit. When planted close to its climatic limits, a young tree needs special protection the first few years until the wood is mature and the growth less rapid. The fig is most at home in southern California, over the Coast Range Valleys, the San Joaquin and Sacramento Valleys to Northern Shasta, and up the lower slopes of the Sierras to about the elevation of 2,500 feet in central California—to 3,000 feet and upward farther south. Magnificent single trees and stately avenues abound in various places. Many trees now standing have trunks 3 feet in diameter. One in Stanislaus County is 80 feet in height; another in Butte County has rooted from drooping branches until it seems a whole grove. This is the notable General Bidwell tree at Chico (Mission Black variety) which covers a circle of 200 feet in diameter and has long been the pride of the region. Superb fig trees are found in all the old foothill and valley towns of California. A magnificent grove is on the old Thurber farm near Vacaville. Large commercial fig orchards have been planted, especially in Nesuo, Los Angeles, Butte, Santa Barbara, San Bernardino, Tulare, Merced, Sonoma, Placer, San Joaquin and Shasta Counties. The Maslin orchard near Loomis and the Roeding orchard east of Fresno are two of the most famous and successful ones in California. Fresno County now has 220,000 bearing fig trees, and Los Angeles nearly 100,000.



1506. Young fig tree, and fig-drying in open air, California.

Varieties.

There are many horticultural varieties known to the markets and catalogues under innumerable synonyms. Their classification is by shape, color of skin and color of flesh. The shape is round or turbinate in some sorts, pyriform or obovate in others. The skin varies in color in different varieties from green through pale yellow, buff, light brown, reddish brown and purple, to black. The flesh is almost white, opaline, or various shades of red; it can be described as melting, spicy, juicy, coarse or even dry in a few old sorts. The size varies from those hardly as large as a green gage plum to others that sometimes weigh four or five ounces apiece. Eisen, in his useful and thorough monograph on the fig published by the Department of Agriculture (Division of Pomology, Bulletin No. 9, 1901) lists and describes nearly 400 varieties from different parts of the world. Eleven of these are Smyrnas, and twenty are varieties of the Capri or wild fig, differing in season so as to afford a succession and thus increase their value in caprification. Baja California, and Sonora, fine regions for the fig, have produced some varieties of promise, and others have been reported from South Africa, New Zealand, Australia, Tasmania, northern India, Algiers and many other places.

When the earlier California nurserymen began to grow figs, they first secured the Black Mission variety which the padres had brought from Mexico, and the little White Marseilles, which was at Santa Clara and Santa Barbara before the discovery of gold. They also obtained from Ellwanger and Barry, of Rochester, and from Berckmans, of Georgia, between 1860 and 1870, all the varieties then grown in America, principally for pot and greenhouse culture, not more than twenty-five sorts in all, chief among which were the Brown Turkey, Celeste, the Green and Black Ischias and the large Brunswick. Georgia and the Gulf coast were cultivating in gardens these sorts for home use, especially Celeste, which is fine for canning and preserving. There was therefore, much early correspondence between California nurserymen like William B. West, John Rock, Felix Gillet, James Shinn and others, and the fig-growers in the South, whose main drawback was in the frequent summer rains. Almost immediately, however, the Californians began to import trees from France, Italy, Spain, and later began to study the Smyrna fig industries. The catalogues of California nurserymen, by 1880, contained about 150 named varieties—with plenty of duplications, as was natural. The University of California experiment stations, by 1890, had about seventy-five varieties under trial and distributed them with great energy. The late John Rock, one of the most ardent horticulturists of his time in America, made many trips abroad and seldom failed to send back new kinds of figs. The inevitable and essential sifting down continued for over thirty years from 1880 until the nurseries of today list not to exceed thirty varieties. The principal sorts now in general cultivation, besides the very important Smyrna and Capri varieties sent out chiefly by George Roeding of Fresno, are the following:

Adriatic (Grosse Verte).
Agen.
Angelique.
Black Ischia (Black Marseilles; Black Provence; the Reculver of England).
Bourjasotte Blanche.
Brown Turkey.
Brunswick.
Celeste (Celestine).
Col di Signora Nigra.
Dauphine.
Doree.
Drap d'Or.
Du Roi.
Lardaro.
Madeline.
Mission (California Black).
Negro Largo.
Pastiliere.
Pingo de Mel.
Ronde Noire.
Ronde Violette Hative.
Royal Vineyard.
San Pedro (white).
Smyrna (common type).
White Genoa.
White Ischia.
White Marseilles.

A large amount of new experimenting has been done in California with fig varieties by the Bureau of Plant Industry which took up the work so well begun by Hilgard and others at the California Station. Lack of means and a general change of the University policy toward the sub-stations (where the fig orchards were located) led to the abandonment of those useful trials about 1902. Fortunately, the United States Department of Agriculture had become deeply interested in the Smyrna fig problem, and soon established plant gardens in California. Beagles, who has charge of the one near Chico, furnishes the following list of the varieties being tested there in 1912, in addition to a great many seedlings and crosses under numbers and not yet in bearing. The list, as furnished by Beagles, is arranged in the order of securing the varieties, not alphabetically, and the first forty-four sorts are from the well-authenticated collection at Chiswick, England:

De l'Archipel.
Bontard.
Grosse Marseilles.
Peau dure.
Negronne.
Bourjassotte noire.
Poulette.
Ceil de Perdrix.
Du Roi.
Grosse Violette de Bordeaux.
Datte.
Monstrueuse.
Bourjassote grise.
A' Bois Jaspee.
Royal Vineyard.
De Grasse.
Euscaire Preto.
Trois recoltes.
Monaco bianco.
Bondance Precoce.
Trifer.
Green Ischia.
Hirta du Japon.
St. Johns.
Vebra.
Datte Quotidienne.
Arbal.
De Jerusalem.
Nebian.
Vigasotte Bianco.
Grise Savantine bifere.
Quarteria.
Douro Vebra.
Reculver.
Gourand Rouge.
D'Agen.
Lampa.
Large Black Douro.
Adam.
De Constantine.
Biberaco.
Grosse Verte.
Violette Sepor.
Dr. Hoggs Clare.
Hardy Prolific.
Figue d'Or.
Recousse noire.
Black Douro.
Grassale.
Martinique.
Crave.
White Ischia.
Brown Turkey.
Pastiliere.
Negro largo.
De la Madeleine.
Col di Signora Bianca.
Doree Nobis.
Pingo de Mel.
Black Ischia.
Toulousienne.
Gouraud noir.
Doree.
Brunswick.
Gentile.
White Adriatic.
Pacific White.
Vendome.
Barbillonne.
Figuires Blanch.
Warren's Brown Turkey.
Capri Milco.
Trojano.
Capri Solms No. 1.
Capri Solms No. 2.
Capri Solms No. 3.
Capri Solms No. 4.
Dauphine.

The California Experiment Station, under Hilgard, found that several varieties which are no longer in ordinary cultivation were important. Chief among these was a French fig of compact growth, Hirta du Japon, a medium-sized, turbinate, dark purple fig of high quality. It is excellent for house culture and for small gardens.

Smyrna figs.

The story of the introduction of the fig-wasp, the indispensable Blastophaga, to California fig orchards is one of the amusing, pathetic and fascinating romances of outdoor life. Smyrna figs were planted early, and they did not bear; the trouble was indistinctly charged to "the climate;" growers laughed at the absurd "book notion" that the Asia Minor Greeks depended on "some sort of an insect" to secure abundant crops of fruit. The late John Bleasdale, who had been in Portugal, told many persons about fig-caprification early in the 1870's. Some of the nurserymen took it up with energy and managed to secure cuttings of Smyrna figs and of Capri figs, but no insects. The San Francisco "Bulletin," between 1880 and 1882, secured and distributed over California about 14,000 cuttings. The fig-growers in Asia Minor became anxious to prevent importation of the insects to California or of the Capri fig cuttings, and the difficulties grew worse. Eisen and Rixford cross-fertilized figs by hand as soon as the wild fig trees blossomed. This was done on the James Shinn farm at Niles and at the California Nursery (managed by John Rock) in the same neighborhood. Then the Roedings of Fresno became interested, through Eisen, and planted a Smyrna fig orchard, but had no Blastophaga. Meanwhile the Department of Agriculture took hold. Walter Swingle was detailed and in 1899 secured the Algerian Blastophaga for the Californians. James Shinn, of Niles, had also obtained the Blastophaga in 1891, but his location was not suitable so that it perished and the work was done over again by both Swingle in 1899 and George Roeding, of Fresno, in 1896, working separately at different points of the problem. But all this time, the fig-wasp had accidentally become established near Modesto, about 1869, on the Gates farm. The wild fig tree there was, possibly, imported by West, of Stockton, in the form of cuttings carrying some of the "mamme" or winter generation of fruits containing the Blastophagas.

The literature of this whole subject is fascinating. It may be studied in the reports of the Department of Agriculture and in the following papers: "Some Points in the History of Caprification and in the Life History of the Fig," Walter T. Swingle, before the Thirty-fourth Fruit-Growers' Convention of California (1908); also his paper on the Maslin seedling fig orchard in the report of the thirty-fifth convention; also papers of his in the thirty-sixth and thirty-eighth reports; an essay by G. P. Rixford, read before the Forty-first Convention of California Fruit-Growers, in Santa Barbara, in 1912. His botanical and entomological paper, read in 1911 before the Pacific Association of Scientific Societies, on the "Fructification of the Fig by Blastophaga" traces the whole subject down from the days of Linnæus. A practical paper on the subject is to be found in George C. Roeding's "California Horticulture," a pamphlet issued in 1909.

Caprification.

The work of study and experimentation has gone forward steadily since the first importation of the Blastophaga; it is likely that more has been done in this line in California in the past twenty years than in all the rest of the world put together. The practical methods of keeping the fig insect prosperously established so that every fruit can be fertilized are now well founded, and as the profits of the industry are generally recognized, large plantings can be expected. There are some obscure problems still undetermined relating to the different crops of figs and the fructification of some of the non-Smyrna types. But in California the industry as a whole finds possibly the most favorable soil and climate known to exist anywhere. It seems probable, therefore, that fig-growing will soon rank in importance with the growing of citrous fruits. The cultivated varieties of Smyrnas are doubtless capable of much improvement as regards size, crop and season.

Only thirty Capri figs are needed to caprify a large fig tree, so abundant are the insects and the pollen in good seasons, and one tree of the wild fig is sufficient for one hundred Smyrna trees. The male of the fig-wasp is without wings, but the female has wings and saw-like mandibles; she cuts her way through scales which interlock over the apex of the half-grown Smyrna fig. She loses her wings in entering, dies in the fig and is absorbed by the vegetable cells. If she lays her eggs they also perish and the continuance of the species depends upon those individuals that remain upon the wild fig trees.

Propagation.

The fig grows readily from cuttings. Use well-ripened wood of the previous season's growth, cut at the joint, and give them the same treatment required for grape cuttings. They will even grow from single-eye cuttings. Bottom heat is not necessary in California where the cuttings are set in nursery in December or January and are ready for the orchard in a year. In the eastern states, winter-made cuttings can be started with bottom heat, or, in April, in the open air.

Budding is best done by the annular or ring method, so useful for the chestnut and walnut. The fig can be cleft-grafted in February in California, but extreme care must be taken to exclude the air. Seedlings are easily grown from the fertile seeds of the imported Smyrna figs, and from the few fertile seeds occasionally appearing in common varieties. Maslin, of Placer County, began to raise seedlings from imported dried figs in 1885 and these are now bearing.

Forcing.

The fig requires more heat under glass than does the grape. The temperatures preferred are, at first, 50° F. at night and, 65° for the day; later increase to 60° or 65° at night and 75° or more in the day. Figs must have much air and moisture till the crop is set. The best varieties for forcing are Early Violet, the White and Brown Ischias, White Marseilles, Hirta du Japon and Negro Largo. A soil of turfy loam with plenty of top-dressing is suitable for pots and tubs. Brown Turkey, Marseilles and Brunswick are the standard varieties for walls.

Cultural methods in California.

The fig tree in California requires much space, hence it is used as an avenue tree or if in orchard form other trees are set between, to be afterward removed. In good soil, fig trees, like walnuts, should finally stand not less than 40 feet apart, and 50 feet is considered to be better.

Little pruning is required for the fig. Trees grown for table figs are headed low, about 18 inches from the ground, to facilitate picking. Trees grown for drying figs are headed higher so that they can better be kept smooth and clean, as the figs are usually allowed to ripen and fall. Cultivation is necessary until the trees completely shade the ground.

Figs begin to bear early in California, often the second or third year. Some trees prove barren or very poor bearers and must be replaced by others. The tree appears to be as long-lived as the olive, has very few insect enemies, and is not subject to disease. It is a good ornamental tree.

The fruit in some districts, in some seasons, ferments on the trees ("fig-sour"). This sometimes seems to come from over-irrigation, sometimes from lack of vitality, and most often occurs in very tender and juicy varieties.

The very dangerous fig moth (*Ephestra cautella*) is now widely distributed in America, although not yet in California. During the last few years, many cargoes of imported figs have been seized in New York and destroyed on account of this insect, which fills the fruit with eggs and ultimately with its larvæ (Bulletin No. 104, 1911, Bureau of Entomology). Asiatic dried figs are not only subject to this pest but contain less sugar (1½ per cent less) and less proteids (1⅓ per cent) than do the California dried figs.

Fig-drying.—The fig crop is handled with much care and cleanliness in California, and labor-saving methods are used in all cases. The figs must remain on the trees till fully ripe; then they shrivel and drop off, are picked up, dipped in boiling brine (three ounces salt to one gallon water), placed on trays exposed to the sun and turned once. The later drying is done in the shade. The figs are next placed in the "sweat boxes" and "mixed" so as to equalize the moisture. They are then washed clean in a weak brine, drained off and taken to the packing-room. Exceeding care, cleanliness and much experience are required to produce high-grade results.

Fig avenues.—There is a growing interest felt in the fig as an avenue tree in California, since it is deciduous and so does not shade the road in winter, and since it thrives without culture or pruning where the moisture is sufficient and the soil deep.

Culture in other places.

While California probably offers the best climate on the continent for commercial fig-growing, the industry has a future over much of Arizona, New Mexico, Texas, the extreme South, Hawaii, Australia, large portions of South Africa, Mexico and the west coast of South America.

Fig-culture in the northern and middle parts of the United States is essentially different, of course, from the outdoor and orchard methods. The tree can be grown as a bush and protected each winter by covering the branches with several inches of soil. In the southern middle states, fig bushes are grown by covering in winter with matting and straw. One crop, or at most two, is all that can be expected. See the discussions on pages 1234 and 1235.

The crop.

Statistics are not well kept at present in the fig industry, but the annual California crop exceeds 4,000 tons (dried figs) while the local consumption of fresh figs is large and increasing. The fig pastes, conserves, and the like, and the use of figs in wafers and other forms is also general. As Smyrna exports about 30,000 tons in good years, there is evidently room for the California industry. The dried Smyrnas of California are equal to the best of Asia Minor and contain 64 per cent of sugar (Roeding's Calimyrna variety, the Erbeyli variety of its native country). Besides this variety, persons at Fresno are planting on a large scale the Kassaba, the Checker Injir of Scios, the Bardajic and what is called in California the purple Bulletin Smyrna.

Related species of Ficus.

The famous and useful "Sycamore fig" of the Orient (*Ficus Sycomorus*) produces fruit in racemes on the older branches. It is too tender for outdoor culture in America. (See page 1234.) The beautiful peepul tree of India is the sacred fig (*Ficus religiosa*) of the Brahmans and Buddhists, and it is now found in many private collections in southern California. *Ficus elastica*, the India rubber tree, is often seen in the warmer parts of California. In 1914 a tree of *F. elastica* fruited heavily at Niles and the children seemed to like the figs. The true banyan fig has not yet been successfully grown in the state, but ought to be tested. In the American tropics many interesting kinds of Ficus may be expected.

CHARLES H. SHINN.

FIG. Adam's Fig: *Musa paradisiaca.* **Barbary Fig:** *Opuntia vulgaris.* **Devil's Fig:** *Argemone mexicana.* **Hottentot's Fig:** *Mesembryanthemum edule.* **Indian Fig:** *Opuntia vulgaris.* **Keg Fig:** *Diospyros Kaki.* **Pharaoh's Fig:** *Sycomorus antiquorum.*

FIG-MARIGOLD: *Mesembryanthemum.*

FÍLAGO: *Gifola.*

FILBERT. One of the group of nuts produced by species of Corylus. The nuts of Corylus are variously grouped or classified; those are usually known as filberts that are provided with a tubular husk much longer than the nut itself; as cobs, if the husk is little or not at all longer than the nut; and as hazels if the husk is much shorter than the nut. The filbert nuts are usually oblong in shape; the cobs roundish and angular; and the hazels rather small, roundish and thick-shelled. These are derived from different species and hybrids of Corylus (which see) of the Old World; and these vernacular names do not seem to be very definitely or accurately used. The name filbert is of disputed origin; the idea that it comes from "full-beard," in allusion to the long husk, is undoubtedly erroneous.

Filberts are grown in many parts of Europe, and they are exported to America in large quantities. Many attempts have been made to grow them in this country but without success owing, apparently, to lack of hardiness, to fungous disease, and to the want of varieties bred for American conditions. Probably some of the failure is due to lack of discrimination in soils and to unskilled methods of growing. See *Hazel-nut.*

L. H. B.

FILIPÉNDULA (Latin *filum*, thread, *pendulus*, hanging; alluding to the numerous small tubers hanging together by thread-like roots). Syn., *Ulmària. Rosàceæ.* MEADOW-SWEET. Hardy herbs grown for their showy panicles of white, pink or purple flowers.

Perennials with fibrous or tuberous rootstock: lvs. stipulate, interruptedly odd-pinnate, the terminal lft. often much larger and palmately lobed: fls. in cymose corymbs; calyx-lobes and petals usually 5; stamens 20–40, with the filaments narrowed toward the base; carpels distinct, 5–15, 1-seeded, indehiscent.—Nine species in N. Asia and Himalayas, N. Amer. and Eu. Filipendula has usually been united with Spiræa, but

is very distinct in its herbaceous habit, pinnate stipulate lvs. and indehiscent 1-seeded achenes.

The meadow-sweets are hardy plants with rather large pinnate or palmately lobed leaves and white, pink or purple flowers in showy terminal corymbs, borne on erect leafy stems rising 1 to 10 feet from a rosette of radical leaves. They bloom in early summer or midsummer and are very handsome border plants. Most of them delight in a rather moist and rich soil and are especially decorative if planted on the borders of ponds and brooklets, but *F. hexapetala* prefers drier situations and likes full sun, while most of the others also thrive well in partly shaded positions. *F. purpurea* should be mulched during the winter in the North. Propagated by seeds sown in fall in pans or boxes and kept in the cool greenhouse, or sown in spring; also by division of older plants.

A. *Lfts. numerous, almost alike, small, pinnately lobed.*

hexapétala, Gilib. (*F. Filipéndula,* Voss. *Ulmària Filipéndula,* Hill. *Spiræa Filipéndula,* Linn.). MEADOW-SWEET. DROPWORT. Fig. 1507. One to 3 ft. high, with tuberous rootstock, glabrous: radical lvs. 6–20 in. long; lfts. sessile, oblong, pinnately lobed and serrate, 1 in. long: fls. in a loose corymb, white, about ¾in. across, with usually 6 petals: achenes about 12, pubescent, semi-cordate. June, July. Eu., W. Asia and Siberia. Var. flòre-plèno has double fls., and is common.

AA. *Lfts. few, the terminal one much larger and palmately 3–9-lobed.*

B. *Lateral lfts. 3–5-lobed.*

rùbra, Rob. (*Spiræa lobàta,* Gronov. *Spiræa palmàta,* Linn. *F. lobàta,* Maxim. *Ulmària rùbra,* Hill). QUEEN OF THE PRAIRIE. Height 2–8 ft., glabrous: terminal lft. large, 7–9-parted, with oblong, acuminate incisely serrate lobes; lateral lfts. smaller, 3–5-lobed, on the upper lvs. missing, green on both sides, only pubescent on the veins beneath: fls. pink, in a rather large paniculate cyme: achenes 6–10, glabrous. June, July. Pa. to Ga., west to Mich. and Ky. Mn. 2:145. B.B. (ed. 2) 2:249. —Beautiful. Var. **venùsta,** Voss. Fls. deep pink or carmine. Var. **álbicans,** Hort. Fls. light pink, or almost white. R.B. 3:169.

1507. Filipendula hexapetala (plant about 2 feet high). Commonly known as Spiræa Filipendula. One of the plants called meadow-sweet.

palmàta, Maxim. (*Spiræa palmàta,* Pall. *Ulmària palmàta,* Focke. *Spiræa digitàta,* Willd.). Height 2–3 ft.: lvs. whitish tomentose beneath or glabrous; terminal lfts. 7–9-parted; stipules large, semi-cordate: fls. pale pink at first, changing to white: achenes 5–8. July. Siberia, Kamchatka and Saghalin.—This species is but rarely cult.; the plant common under the name *Spiræa palmata* belongs to *F. purpurea.*

BB. *Lateral lfts. none or few and ovate.*

C. *Achenes usually 5, ciliate: lateral lfts. none or few.*

camtschática, Maxim. (*Spiræa camtschática,* Pall. *Spiræa gigantèa,* Hort. *Ulmària camtschática,* Rehd.). Height 5–10 ft.: lvs. glabrous or villous beneath, often with rufous veins; terminal lft. very large, cordate, 3–5-lobed, with broadly ovate, doubly serrate lobes; lateral lfts. usually none; stipules large, semi-cordate: fls. white. July. Manchuria, Kamchatka.

purpùrea, Maxim. (*Spiræa palmàta,* Thunb. *Ulmària purpùrea,* Rehd.). Height 2–4 ft., glabrous: terminal lft. very large, cordate, 5–7-lobed, with oblong, acuminate, doubly serrate lobes; lateral lfts. none or few, oblong-ovate; stipules narrow: fls. carmine or deep pink, in large paniculate cymes with crimson peduncles and sts. June–Aug. Japan. B.M. 5726. I.H. 15:577. F.S. 18:1851. J.H. III. 51:201. F.W. 1869:33. Gn. W. 23: suppl. June 16. Gn. 17:36.—This is undoubtedly the finest species of this genus. It is also sometimes grown in pots and forced. Var. **álba,** Hort., has white fls. and var. **élegans,** Voss, white fls., with red stamens and usually several lateral lfts.; the latter is said to be a hybrid. R.B. 4:7. G.Z. 22:25.

CC. *Achenes about 10: lateral lfts. present, ovate.*

Ulmària, Maxim. (*Spiræa Ulmària,* Linn. *Ulmària pentapétala,* Gilib. *U. palústris,* Moench). QUEEN OF THE MEADOWS. Height 2–6 ft.: lvs. glabrous or puberulous above, whitish tomentose beneath; terminal lfts. 3–5-lobed, 2–4 in. long, lateral lfts. smaller, ovate, coarsely doubly serrate: fls. white, in rather dense paniculate cymes: achenes about 10, semi-cordate, almost glabrous, twisted. June–Aug. Eu., W. Asia to Mongolia; naturalized in some places in the eastern states. B.B. (ed. 2) 2:249. Var. **denudàta,** Maxim. (*F. denudàta,* Rydb.). Lvs. green beneath and nearly glabrous. Var. **aùreo-variegàta,** Voss, has the lvs. variegated with yellow. Var. **plèna,** Voss (var. *flòre-plèno,* Hort.). Fls. double.

F. angustifòlia, Maxim. (Spiræa angustifolia, Turcz. Ulmaria angustifolia, Rehd.). Similar to F. lobata: fls. white: lvs. glabrous or whitish tomentose beneath. Dahuria, Manchuria.—*F. vestita,* Maxim. (Ulmaria vestita, Rehd. Spiræa vestita, Wall.). Similar to F. camtschatica, but only 1 ft. high and lvs. grayish tomentose beneath: fls. white. Himalayas. B.R. 27:4 (as S. kamschatica var. himalensis).

ALFRED REHDER.

FINGER-GRASS. Species of *Chloris* and *Panicum.*

FIORIN: *Agrostis stolonifera* and *A. alba.*

FIR. Strictly, species of the genus Abies, but popularly it includes many trees known to nurserymen and others as Picea, and by some it is applied to Pinus, Larix, and others.

FIRE-CRACKER, FLORAL: *Brevoortia.*

FIRE-ON-THE-MOUNTAIN: *Euphorbia heterophylla.*

FIRE-PINK: *Silene virginica.*

FIRE-PLANT: *Euphorbia heterophylla.*

FIRE-WEED: *Epilobium angustifolium* and *Erechtites hieracifolia.*

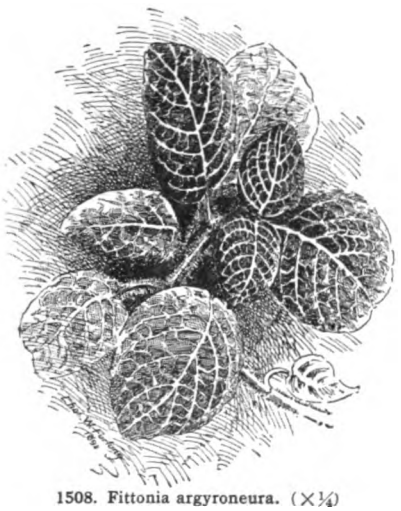
FISH-GRASS: *Cabomba.*

FITTÒNIA (Elizabeth and Sarah Mary Fitton, authors of "Conversations on Botany," and friends of Robert Brown). *Acanthàceæ.* Low-growing herbaceous perennials, valued for the brilliant variegation made by red or white venation of their large heart-shaped leaves.

Leaves prominent or rather large, cordate, beautifully veined: fls. borne singly in the axils of the overlapping bracts, which form a peduncled, terminal spike; calyx-segms. linear-bristly; corolla-tube slender; lip long, narrow, shortly lobed at the apex; stamens 2, affixed near the throat; style filiform, truncate at apex: fr. an ovate-acute 4-seeded caps., some of the seeds likely to be aborted.—Species 3, in Peru. Fittonias may be grown with philodendron, *Cissus discolor, Episcia cupreata,* nephthytis and selaginellas. There is often a bare, unsightly space under the benches that can be transformed into a tangle of tropical creepers by the use of such plants. A board may be placed slanting toward the walks and covered with rotten stumps, chunks of peat, and moss for the plants to run in. The open borders near the walks have

hardly sufficient drainage. They may also be pegged down in mossy coverings for tubs of palms, as they can stand much watering.

Fittonias are most useful and ornamental plants for growing in a deeply shaded place in the tropical greenhouse. The beautiful markings of their foliage always attract attention; and being of easy culture, they can be used effectively for places in the foliage house in which no other plant would thrive. The best time to root fittonias is early spring, as after a year's growth they are likely to have a rather straggling appearance, and need a general overhauling. Remove the points of the shoots, with two leaves attached, and one joint to insert in the sand. These make the best cuttings, but any part of the stem will root and grow provided there is a joint on it. After cuttings are rooted, which will be in two or three weeks in a temperature of 65°, pot them singly in 2-inch pots, in equal parts of loam leaf-mold, and sand.—When they are well rooted in these small pots, choose the size of pan they are intended to grow in, and fill it with the same proportion of loam, leaf-mold and sand, as advised for the first potting. This time, however, the loam is better to be more of fibrous and in a rather lumpy state, and the leaf-mold should not be too well rotted, but rather flaky in texture. In filling the pan with the compost, raise it in the center above the rim. This gives the plant a mound appearance, which adds to its beauty. The small plants should be planted in the large pan about 2 inches apart; water them gently with a fine rose, so as not to disturb the earth in the receptacle. As stated above, these plants require, at all times, to be grown in a shady position, and except in the dead of winter should never be in a temperature of less than 60° by night. In severe zero weather, it will not harm them to drop as low as 55°.—Pyramid-shaped plants of some of the fittonias can be grown. Pot them along singly and tie them to a stake. When about four or five pairs of leaves are formed, pinch out the heart of the plant. This will encourage side breaks to start, which should be pinched after they have made three pairs of leaves. After the leading shoot has been pinched, two breaks will start away, and after two leaves have been well formed, one of the shoots should again have the heart taken out of it. The other must now be taken for the leader and allowed to make three or four more joints before it is stopped again by removing the heart. In this way the desired height will be attained, and at the same time plenty of side breaks will be encouraged to start. The side shoots must be carefully watched; pinch back all the strong shoots, so that a plant of symmetry may be formed. When these plants are well rooted in the pans, or have attained the desired size in pyramid form, water them occasionally with soft-coal soot, a handful to an ordinary watering-pot, which generally contains about two and a half gallons. Water twice in between with clean water. The soot tends to bring out the brilliancy of the markings, making the whole plant have a ... ance. Scale, and other insect pests ... found on these plants, but if fumiga... cyanic gas, as advised for other plant... little trouble. (George F. Stewart.)



1508. Fittonia argyroneura. (×¼)

A. *Habit erect: height 1½ ...*

gigantèa, Lind. (*Gymnostàchyum g...*). Sub-shrubby, branching, 1½ ft.: sts ... only between the joints, with 4 ranks ... erect hairs: lvs. opposite, elliptical, no... base, with 2 ranks of hairs, tapering r... other species, dark, shining green; ve... fls. pale, with a reddish brown band in t... side and upper lobes, and a dark yellow ... dle of the lower lip. R.H. 1869, p. 18... 11.

AA. *Habit trailing or dwarf: height ...*

B. *Veins of lf. red.*

Verschaffèltii, E. Coëm. (*Fittònia* and *Eránthemum rubronérvum* and *rubrovenòsum*, Hort. *Eránthemum rùbro-vènium*, Veitch. *Gymnostàchyum Verschaffèltii*, Lem.). Lvs. ovate, notched at the base, dull green, often yellowish, veined carmine. F.S. 15:1581. I.H. 10:372. Var. **Pèarcei,** Hort. (*F.* and *G. Pèarcei*, Hort.). Lvs. light, bright green; veins light, bright carmine; under surface somewhat glaucous. Var. **Dàveana,** Hort. (*F. Dàveana*, Hort.). "Foliage with light center, bordered very dark green." More robust than the type and with veins of stronger red.

BB. *Veins of lf. white.*

argyroneùra, E. Coëm. Fig. 1508. Dwarf: lvs. dark, shining green. F.S. 16:1664. Gn. 36, p. 527; 2, p. 319. G. 11:7.—The velvetiness of the upper surface of *F. Verschaffeltii* is due to large projecting epidermal cells with an apical nucleus. Instead of these characteristic cells, *F. argyroneura* has small cells and conical hairs, which are partitioned off and have tubercles at the base.

WILHELM MILLER.

FITZRÒYA (Capt. R. Fitzroy, of the British Navy; died 1855). *Pinàceæ*. Two evergreen trees or shrubs, one of the mountains of S. Chile (*F. patagònica*, Hook. f. B.M. 4616), and one of Tasmania (*F. Árcheri*, Benth.). Lvs. small, 3-verticillate or decussate-opposite, imbricated: catkins very small, globose. They are little known in this country, and may be expected to thrive only in the milder parts. The former species is a tree, has lvs. mostly verticillate, ovate-oblong, in 2–4 rows, anthers commonly 4-celled, 3 ovules, and seeds 2-winged; the latter is bushy, has opposite decussate keeled lvs., anthers 2-celled, ovules 2, seeds 3-winged. The Biltmore Nursery, N. C., lists *F. patagonica*, "a tree of variable dimensions, native of the Andes, from Chile to the Straits of Magellan. Lvs. dark green above, with 2 white lines beneath. . . . Its value in cult. in the U. S. has not yet been fully proved;" but it is said to possess sufficient hardiness to withstand the winters in the S. It is reported as being hardy in S. England. It is monœcious, the small cones consisting of about 9 scales; the lvs. on small trees are reported as varying much in the way in which they stand on the st., but they are 4-rowed and decurrent; pollen-sacs mostly 4.

L. H. B.

FIVE-FINGER: *Potentilla.*

FLACOÙRTIA (Etienne de Flacourt, 1607–1660, General Director of the French East India Company, Governor of Madagascar and author of a history of Madagascar). *Flacourtiàceæ*. One of the species, a shrub with edible fruits, is cultivated in the tropics and has been introduced in southern California and perhaps elsewhere.

Shrubs and small trees, often spine-bearing: lvs. short-stalked, toothed or crenate, simple, alternate: fls. small, dicœcious, in small racemes or glomes or panicles (the fertile ones sometimes solitary); sepals

4–5, scale-like, ciliated, overlapping; petals none; stamens many; styles 2 to many; ovary 2–5-celled: fr. a berry, often edible, usually with 1 seed in each cell. —Fifteen to 20 species in Trop. Afr., Asia, and islands.

Ramóntchi, L'Her. GOVERNOR PLUM. BATOKO PLUM in the Zambesi region. Fig. 1509. An excessively variable shrub or small tree, as customarily defined, native in Trop. Afr. and Asia, and planted in the American tropics: glabrous or nearly so, spiny or spineless (spines axillary): lvs. oblong to elliptical and obovate, obtuse or pointed, variously crenate-dentate, short-petioled: sterile fls. in short racemes, the fertile few or solitary or in pairs, all small; styles 5–7, very short, radiate: fr. cherry-like, to 1 in. diam., roundish and pulpy, with 8–10 seeds, purple, red, or blackish, bearing on top the remains of the stigmas; edible, ripening in the farther West Indies early in the year but some specimens sometimes remaining till Sept. There are various forms, as var. *inermis* and var. *macrocarpa*. Hooker & Thomson in "Flora of British India" recognize 5 marked varieties, and include within the species *F. sapida* of Roxburgh. The species is reported as "common throughout India, wild or cult." and as having a distribution from Madagascar to the E. Archipelago. Duthie, in "Flora of the Upper Gangetic Plain," says that the var. *sapida* (with pubescent branchlets, elliptic or suborbicular lvs. which are glabrous or puberulous only on the veins beneath) produces fr. that is eaten raw or cooked, and twigs and lvs. that are used as fodder. "Ramontchi" is said to be the native name in Madagascar. L. H. B.

FLAG: *Iris.* **Cat-tail Flag:** *Typha.* **Corn Flag:** *Gladiolus.* **Sweet Flag:** *Acorus Calamus.* **Yellow Flag:** *Iris Pseudacorus.*

FLAMBOYANT: *Poinciana.*

FLAME-TREE: *Sterculia acerifolia.*

FLAX: *Linum.* **False Flax:** *Camelina.* **New Zealand Flax:** *Phormium tenax.* **Toad Flax:** *Linaria.*

FLEABANE: *Erigeron.*

FLEMÍNGIA (John Fleming, Pres. Medical Board of Bengal; author of "A Catalogue of Indian Medicinal Plants and Drugs," 1810). *Leguminòsæ.* Of this genus, two shrubs are cultivated in southern California and southern Florida.

Herbs, sub-shrubs or shrubs of the Old World tropics, erect, prostrate or twining: lvs. mostly with 3 digitate lfts., rarely 1; stipules striate, often caducous: fls. papilionaceous, red or purple and mixed with yellow, in crowded racemes or panicles, or sometimes solitary; standard obovate or orbicular, auricled at base; wings obliquely obovate or oblong, often adhering to the incurved or nearly straight keel; stamens 9 and 1: pod short, oblique, swollen, 2-valved.—Species above 20, mostly of Trop. Asia, but occurring also in Trop. Afr. and to the Philippines. Allied to Dalbergia and Rhynchosia.

congésta, Roxbg. Shrub, 4–6 ft., erect: lfts. oblong or broadly lanceolate, the side ones 2-nerved, middle one 3-nerved: racemes axillary, dense, shorter than the lf.-stalks; fls. purple, with a silky-hairy calyx and a scarcely exserted corolla: pod ⅝in. long, 2-seeded.—A variable species of India.

strobilífera, R. Br., has been intro. in S. Fla. It is an erect shrub, 8–10 ft., with slender velvety branches: lvs. simple, oblong, subacute, rounded at base, somewhat silky beneath: racemes zigzag, 3–6 in. long, with very large bracts that hide the fls.; calyx ¼in. long, hairy and with lanceolate teeth; corolla purple: pod less than ½in. long. India. L. H. B.

FLOATING HEART: *Limnanthemum.*

FLOÉRKEA DOÚGLASII: *Limnanthes.*

FLORA'S PAINT-BRUSH: A common name for *Emilia flammea.*

FLORICULTURE, or the growing of plants for ornamental purposes, particularly for flowers, is yearly assuming larger proportions in the United States. The industry consists in growing annual, biennial and perennial plants either under glass or outdoors, and in the

1509. Flacourtia Ramontchi. (×½)

disposal of the same in wholesale or retail markets. These products are sold as cut-flowers or potted plants to be used for indoor or outdoor home ornamentation, or for planting in public parks, about schools and other public buildings, or in cemeteries for ornamental purposes. (For home flower-gardens, see p. 1747.)

Importance of the industry.

The floricultural statistics taken from the census of 1910 show a marked increase in the importance of this branch of agriculture within the previous decade. The acreage, as given for this census, was 18,248 as compared with 9,307 as given for the census of 1900. The total valuation, as given in this census, was $34,872,000, an increase of 85.9 per cent as compared with the report of the census for 1900. The figures were compiled in nine large geographical divisions of the United States. These were New England, Middle Atlantic, South Atlantic, East North Central, West North Central, East South Central, West South Central, Mountain, and Pacific.

From its beginning the industry has centered around such large cities as Boston, New York, Philadelphia, Baltimore and Washington. The business is now assuming considerable importance in Chicago, St. Louis and other large cities in the Middle States, the South and West. Statistics show that the largest floricultural output comes from the Middle Atlantic section. The states which compose this section are New York, New Jersey and Pennsylvania. The total valuation of products from this section is $11,810,076. The second section of importance is the East North Central, composed of Ohio, Indiana, Illinois, Michigan and Wisconsin, in which the figures given were $9,029,125. The third important section was New England, where the total valuation was $4,677,316. The smallest output comes from the Mountain section, composed of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada. Here the output was $753,914. The most rapid increase in the industry during the decade seems to have been in the Pacific section, composed of Washington, Oregon and California, where the valuation of flower products sprang from $726,968 in 1899 to $2,175,572 in 1909. New York leads other states in floricultural products, having an output of $5,110,221. The rank of other important states is Pennsylvania, Illinois, New Jersey, Massachusetts and Ohio.

Floriculture is intensive agriculture; consequently the acreage devoted to the industry is not so large as in other branches of agriculture. The amount of capital

invested in glasshouses and their equipment is considerable. The return from the products, however, is immediate. Commercial growers and men making a business of greenhouse construction, estimate that it costs from 60 to 90 cents a square foot of ground covered to build and equip a modern range. The growers estimate that the products from such an area the first year should cover the cost of construction.

The flower-growing industry in the United States has not yet assumed the large proportions that it has in many European cities. The early colonists were an extremely practical people and paid little attention to the distinctly ornamental features about the home. As wealth increased, however, there came to be a more liberal use of flowers and plants; hence a larger demand for them in the industrial world.

Floricultural statistics for the Dominion of Canada are less complete than for the United States. The following are figures furnished through the courtesy of W. T. Macoun, Dominion Horticulturist:

Capital invested, approximately	$1,500,000
Square feet of glass	6,000,000
Annual output	$1,000,000
Area covered	120 acres

History of the industry.

The early history of the floricultural industry is obscure. It was merged to such an extent with other branches of horticulture and other industries that it could hardly be called a distinct industry. Previous to 1825 there is record of but few commercial flower-growing establishments. From 1830 to 1840, rapid progress was made in all branches of the work. The demand for glasshouse products increased to a considerable degree. Better houses were built, better systems of heating were devised, and consequently better products were put on the market.

Even the glasshouses of this period were extremely crude affairs. The framework was of large dimensions, the glass small in size, heavy and thick. The roofs were largely portable, being made of sash. About 1855 the first house having permanent sash-bars was built by Frederic A. Lord in Buffalo. The wooden superstructure of this house was heavy and the interior light conditions correspondingly poor, but it was a vast improvement over sash-houses. This type of construction was met with favor by glasshouse men, and many houses of a similar type soon were built. Glass of larger size was used, and this was embedded in putty instead of being placed on the outside as in sash-houses.

Previous to 1870 the principal business of the florist was the growing of potted plants. The flowers from these were often sold as cut-flowers, but the business centered about growing potted plants for outdoor bedding and other ornamental purposes. The cut-flowers of that early period were comparatively of a small-flowered, short-stemmed sort—heliotrope, camellia, tuberose, bouvardia and those of a like nature. Although the carnation was introduced as a florist crop about 1852, it was of little commercial importance previous to this date. About 1865, Dailledouze & Zeller of Flatbush, Long Island, began to breed the carnation, and between 1866 and 1872 several new varieties were introduced by this firm. Garden roses had been popular for many years, but few attempts were made to grow them under glass previous to 1870. They then came rapidly into public favor.

From 1870 to 1880 the demand for both potted plants and cut-flowers increased rapidly. More attention was paid to city and home ornamentation, and consequently more park and private conservatories were built. Each year witnessed improvements in construction, and consequently better grades of florists' products. In the last twenty years the advances which have been made in cultural conditions and the improvements in florists' crops have completely revolutionized the industry.

Improvements in glasshouse structures, and their heating.

The tendency among flower-growers now is to build large houses in preference to smaller ones. It has been proved that the cost of construction is cheaper and that these may be more easily heated, that plant-growth is healthier because of a more uniform temperature, that they are easier to construct and can be cared for with greater economy of labor. Glass of larger size is now used, and more attention is given details of construction to increase the light factors in the house. There have been many changes in methods of heating glasshouses during their history. From the crude methods of flues, various devices for heating with hot water and steam have been devised. Both of these methods have their advantages. In the earlier methods of hot-water heating, the pipes were large and the system was an expensive one to install. Steam, therefore, came into popular favor, especially in large commercial establishments. It is still generally used. In some sections of the country and in the growing of some species of plants, hot water is still used; but here better systems for forcing the circulation of water have been installed so it is possible to use pipes of smaller dimensions.

Improvements in flower crops.

The work of the plant-breeders began to produce results in the the early nineties of last century. Many new varieties of chrysanthemums and carnations were put on the market. The violet then became an important florist crop. The early part of the twentieth century, however, witnessed a deluge of new varieties in practically all species. Breeding and improved cultural methods brought the qualities of the products far above anything produced in the previous century. Large-flowered carnations on long, stiff stems, violets of much larger sizes, and improved strains of chrysanthemums, roses and other species gave a remarkable impetus to the industry.

Previous to the beginning of the twentieth century, the American florist had interested himself in the culture of a wide variety of plants. In many cases the larger part of the products were sold at the range. The business, however, assumed such proportions that many up-to-date florists found that they could not profitably raise and dispose of their products at retail; consequently the retail flower-stores became more and more important factors in the disposal of the products. Wholesale commission houses and wholesale flower-markets were established in the larger cities so that the grower could devote nearly his entire time to the production of his crop. Many of the more progressive florists came to feel that they could not afford to grow a wide variety of plant species, but that it paid them better to grow one or two crops and to devote their whole attention to growing these in the finest manner possible so that they could produce flowers which were first quality in every respect; hence men came to be known as carnation, rose, violet, chrysanthemum, fern, palm and other specialists. This led to a wonderful improvement in the quality of flowers produced, and there was no call in the market for the inferior grades.

The buying public has had its influence in producing a better quality of florists' products. It has demanded not only better quality but something out of the ordinary. People tired of roses, carnations, violets and bulbous stock continually. The early part of the twentieth century witnessed a remarkable interest in orchids. The commercial man had to meet this demand. Twelve years ago an orchid could hardly be found outside of private conservatories. They were considered impossible to grow with financial success. Today nearly every

XLIII. Floriculture.—A house of begonias, with a row of ferns.

up-to-date retail grower has his section of orchids, and nearly every large floricultural center has its orchid specialist. For many years it was considered impossible to get satisfactory results from sweet peas under glass. The introduction of new strains and careful study of cultural conditions made the culture of this crop possible. The forcing of hardy herbaceous perennials like antirrhinums, delphiniums, and the like, and the forcing of hardy shrubs and other rare, hardy stock has furnished the flower-grower with a wonderful range of the more unusual plants.

Many large American flower-producers are now managing their business on a departmental scale. There are retail and wholesale departments; palm, carnation, orchid, rose, chrysanthemum and bedding departments, each in charge of a specialist in growing that particular crop.

The flower exhibitions held from time to time in the larger cities have had a beneficial effect on the uplift of the business. These exhibitions have been viewed by thousands of retail buyers. The choicest products of the flower-grower's skill have been exhibited, and the public has become dissatisfied with the inferior grade of commercial flowers offered for sale in the average flower-shops. They have demanded better products, and it has been the work of the flower-grower to produce these qualities.

Literature.

Within the last ten years there has been a remarkable increase in literature on flower-growing. Such papers as "The Florists' Exchange," "The American Florist," "Florists' Review," "Horticulture," "Gardening," "Gardener's Chronicle of America," have kept the grower closely in touch with the work in the gardening world. Many publications for the amateur, like "The Garden Magazine," "Country Life in America," "House & Garden," "Suburban Life" have assisted in giving the American people much valuable information regarding flower-growing about the home.

A long list of books might now be given, dealing with commercial and home flower-growing. Among these, valuable for the commercial man, are: "The American Carnation," C. W. Ward; "Commercial Rose-Culture," Eber Holmes; "Chrysanthemums for the Million," Charles H. Totty; "Violet-Culture," B. T. Galloway; "Orchid Culture," William Watson; "Florist's Manual," William Scott; "Plant-Culture," G. W. Oliver. Excellent books for the amateur are: "The Rose," H. B. Ellwanger; "Window-Gardening," H. B. Dorner; "The Garden Month by Month," Mrs. M. C. Sedgwick; "Making a Bulb Garden," Grace Tabor; "Roses and How to Grow Them," Doubleday, Page & Co.; "House Plants and How to Grow Them," Parker T. Barnes.

E. A. WHITE.

FLORIDA ARROW-ROOT: *Zamia integrifolia.*

FLORIDA SWAMP LILY: *Crinum americanum.*

FLORISTS' PLANTS. A half-century ago the florist plant trade, although perhaps relatively of greater importance than at present, was not a prominent feature of the holiday trade. At Christmas there was some acceleration in the business, but this was overshadowed by the trade in cut-flowers. Easter was not a time of great plant sales. Church decorations in Protestant churches were not common. The sales of plants were more evenly distributed throughout the year, and the variety of plants sold was greater because the grower and consumer came in contact with each other, thus enabling the grower to dispose of plants which would not withstand the handling experienced by the plants of the present day. With the changing conditions in the family life of city residents, plants are no longer largely desired for window-gardens, but for temporary decoration of the living-rooms. The old type of plant-grower with his botanical collection has passed away, and in his place is the large commercial grower of a few staple plants which are grown in perfect condition. These growers produce a large quantity of plants for Christmas and then begin operations for Easter, as both of these dates now are times for the sending of gifts.

The trade in florist plants in the U. S., including bedding plants, is not less than $10,000,000, and it is encouraging that it is annually increasing without any diminution in the volume of the cut-flower business. Every up-to-date florist makes Christmas and Easter displays, and often special exhibits of chrysanthemums, and so on, are made when in season. The most successful of these displays are made in houses arranged for the purpose, for when made in an ordinary greenhouse with high benches, the taller plants are above the level of the eye and the effect is sacrificed. The best houses for displays are those of the conservatory type such as are seen in connection with some of the best flower

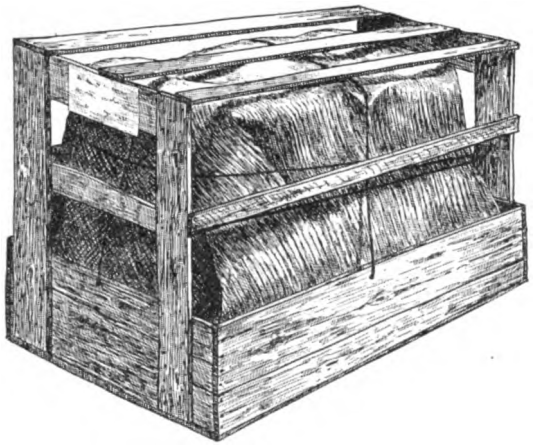
1510. Pot-plants being packed for shipment.

stores. An ordinary greenhouse is often adapted for the purpose by constructing low benches, 18 to 20 inches high, for displaying bulbous plants and omitting them entirely for tall plants. The object sought in all cases is to have the plants placed so that the buyer looks down upon them. The show house is not very large for the reason that it is not always advisable to have too many plants of a kind in sight and also because at Easter the occurrence of warm, bright, unseasonable weather prevents keeping the plants in good condition. It is generally recognized that the display must be maintained in good condition by removing all unsightly plants and faded flowers. The stock should be replenished and rearranged every day.

The good salesman is one who has a knowledge of the care of plants, as well as their good points, their appropriateness for special occasions, and so on. Judicious advice on these points has much to do in winning and retaining customers. When a sale is made, the plants are carefully tagged with the correct address and the time it is to be delivered. If the plant is intended as a present, the sender's card is usually

placed in a waterproof envelope which is fastened to the delivery tag. Deliveries of Christmas and Easter plants particularly should be promptly made, for nothing creates more dissatisfaction than late delivery. This requires skill in systematically arranging the plants according to the delivery routes, thus avoiding traversing the same territory a second time. It is axiomatic that the plant should be at its best on the day or at the function for which it is to be used. The weather has much to do with the condition of plants upon delivery. At Christmas, stock may be sent out twenty-four hours in advance, while at Easter stock delivered thus far in advance may not be satisfactory on Sunday.

All plants in pots, with the possible exception of the woody kinds, are staked and tied before handling. Plants are neatly wrapped with several thicknesses of paper to insure safe delivery. Plants with flowers which are easily bruised are usually wrapped with a sheet of cotton batting or waxed paper and then six to eight thicknesses of newspaper with clean plain paper



1511. The completed crate for shipment.

outside. When plants must be shipped in cold weather, they must be wrapped as indicated and then set in strong wooden boxes. These boxes are approximately 4 feet long, 2 feet wide, and 8 inches deep. The corners are strengthened by the use of extra cleats. The box is first lined with corrugated paper, and then several thicknesses of newspaper which are left hanging over the edges of the box all around. Slightly dampened excelsior is used around the pots to prevent breakage and to make the package secure. The paper is then brought up over the plants and fastened (Fig. 1510). Over the top a frame is built of ½ x 4-inch cleating lumber which prevents damage to the plants (Fig. 1511).

The number of plants that can be had in perfection at Christmas is limited and does not change from year to year. Among the leading flowering plants are poinsettias in pots and pans, azaleas, cyclamen and Lorraine begonias. The more expensive plants are ericas (*E. melanthera*) and camellias.

The berried plants commonly grown are the Jerusalem cherry (*Solanum Capsicastrum*), Christmas pepper (*S. Pseudo-Capsicum*), aucubas, ardisias, holly and Otaheite oranges.

The foliage plants include araucarias, boxwood, crotons, nephrolepis, *Pandanus Veitchii*, *Ficus pandurata* and *F. elastica*, Dracæna (*D. terminalis*, *D. fragrans*, *D. Mandæana*, *D. Godseffiana*, *D.* Lord Wolseley) and Adiantum.

Easter is a great plant day and there is a great variety of suitable plants. The leading flowering plant is, of course, *Lilium longiflorum*.

It would be difficult to determine the relative market value of the different plants, but among the bulbs tulips, hyacinths, narcissi and lilies-of-the-valley are staples. These are sold in pots or pans, singly or in plant combinations. A very large amount of bulbous material is sold at Easter. Cinerarias, *Primula obconica* and *P. sinensis* are a smaller factor than formerly on the large city markets, but still remain an important item in the smaller cities. Marguerites and spirea (*Astilbe japonica*), when well grown, find a good sale in New York. A number of violets and pansies planted in low dishes, and small blooming geraniums, from 3-inch pots, planted in 6- to 12-inch bulb pans, are salable plants in many localities. Among the shrubs the azaleas are most important, although in some cities they show a decline in popularity. Following these are genistas, which have been for many years a popular Easter plant. *Hydrangea rosea* and *H. Otaksa* were long standard varieties, but now will probably give way to the new French varieties. In some cities hydrangeas are less used for Easter than for Memorial Day. Lilacs, Charles X, Marie Legraye and Madame Lemoine are among the best. The lilac has the disadvantage of a great display of wood and leaves before the terminal flowers charm the eye. It therefore requires accessories to relieve this effect, and the demand for this plant is limited. Rhododendrons are slowly gaining in popularity. Acacias and ericas are becoming more common each year. *Acacia longifolia* and *A. paradoxa* are now grown for market. *Erica Cavendishii* is used for individual plants, while *E. cupressina* is used in making up baskets of plants. *Bougainvillea Sanderiana*, like the rambler roses, may be made to assume definite forms which are especially beautiful when the bracts are well colored. Among the other shrubs more or less common are *Azalea mollis*, *Deutzia gracilis*, *Spiræa Van Houttei*, double almond, hawthorns, and *Wistaria multijuga*. In the last decade the rambler roses have taken a prominent place among Easter plants and each year a larger number are grown. The crimson rambler was first used, but is now superseded by the more beautiful Dorothy Perkins, Tausendschon, Lady Gay, Newport Fairy and Hiawatha. The rambler roses possess the advantage that they can be trained into pleasing forms. The polyantha roses are popular also, and among the varieties used are Madame Norbert Levavasseur (Baby Rambler), Mrs. Cutbush and Orleans. The latter are very satisfactory when sold either as individual plants with waterproof crepe paper pot-covers or in baskets with other plants. The hybrid perpetuals are still grown, but not in so large quantities as formerly. The varieties now grown are Frau Karl Druschki, Mrs. John Laing and Magna Charta.

Easter brings a demand for some of the larger sizes of foliage plants for decorations in churches, retail stores, and the like. The small-sized ferns, dracenas and palms are required in making up baskets of plants.

The florist of fifty years ago thought that a good blooming plant did not need any aids to make it attractive. This has changed, and the florists are seeking every means to make their plants more attractive. The most inexpensive method of doing this is to use pot-covers of waterproof crepe paper in color suited to the subjects. Porto Rican or raffia matting in color is used in a similar manner.

The trade of the present day disposes of a great many plants in baskets or boxes. Individual plant-baskets, with handles, to hold even as large as 6- to 8-inch pots are often used. Baskets, usually of the peach-basket shape, are also utilized for an endless variety of combinations of flowering and foliage plants (Fig. 1512). The baskets are supplied with a metal receptacle or lining so that the pots may be removed from the plants, giving them the appearance of having been grown together. Formerly these receptacles were filled by the retailers, but now many are prepared at

the greenhouses according to order and sent to the stores where all that is needed is to add the basket and the ribbons. The latter plan relieves the store of much work in the busy season, but may not result in as artistic combinations as can be secured by a person trained in the work. The manufacturers of florist supplies are striving to meet the demand for something new in baskets and boxes. New material, weaves and shapes, are seen every year. There is also a great variety of coloring. There are green, gilt, white, red, ivory, bronze and copper shades as well as two-tone effects, as red and green, white and green, blue and white, pink and white, and yellow and white. The variety offered is such that baskets can be secured in sizes to suit either the high-class or popular trade. The small florist

1512. A made-up basket of living plants.

usually begins by using some of the willow, rattan or splint baskets which are filled with inexpensive plants. Cedar tubs, wood and terra-cotta boxes are also used. The demand for pleasing arrangements of flowering and foliage plants in boxes, jardinières, hampers, baskets, pans and dishes of fanciful design, light and airy, dainty and graceful, is increasing and is receiving the attention of the growers of holiday plants. It is generally recognized that the work offers as wide a scope for inventive genius and artistic discernment as any phase of the florist business. A. C. BEAL.

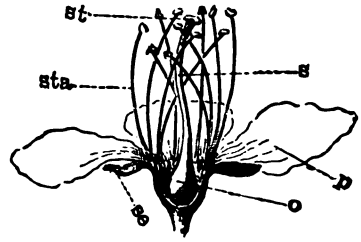
FLOWER is a popular or semi-technical term for the aggregate of structures having to do with sexual reproduction in the higher plants. The concept usually includes color, and a definite organization as outlined below; therefore, gymnosperms, ferns, and the lower plants are said not to have true flowers. As ordinarily understood, the flower is a showy structure useful for esthetic purposes, gratifying in color and often in odor, and in some way intimately connected with the production of seed; but analogous although inconspicuous structures are sometimes popularly recognized as "flowers." To the layman, many of our common herbs, shrubs and trees are said not to bear flowers at all, although the botanist recognizes that at least inconspicuous greenish flowers are borne by all of these plants unless they be ferns or gymnosperms.

Botanically considered, the flower when complete consists of four sets of organs from the center outward: the gynœcium, andrœcium, corolla, and calyx, to which may possibly be added a fifth, the disk (Figs. 1513-1516).

1513. Longitudinal section of a buttercup flower.

The gynœcium Figs. 1517-1519).—In the center are one or more small flask-like or pouch-like organs (*pistils*) which are hollow and contain tiny bud-like growths (ovules). The pistils collectively are termed the *gynœcium* (female household). The hollow ovule-bearing part of the pistil is the *ovary*. At the summit of the ovary is a more or less sticky or roughened surface, the *stigma*, which may rest directly on the ovary (*sessile*) or may be raised aloft on a stalk (the *style*). From the ovules seeds are developed (see *Fertilization*).

The fundamental or unit foliar organ of the gynœcium is termed a *carpel*. In the simplest case there is but one carpel, folded to form a pouch with the upper ventral leaf-surface within, and the margins forming a suture down one side. The structure thus formed is a *simple pistil*. The suture bears the ovules and is termed the *placenta*, and is normally ovuliferous throughout, but frequently only the uppermost or basal ovule of the row is present (*apical* and *suspended*, or *basal* and *erect*). In other cases there are several or many carpels but these remain distinct, then forming many simple pistils. In most cases, however, the carpels are more or less fused, at least below, and the resulting pistil is said to be *compound*. The sutures are axially placed and the midribs are outward (anterior), the ventral surface of each carpel lining the ovarian cavity. There are, therefore, normally as many cells or locules in a compound ovary as there are carpels. Through the partical opening-out of each carpel while the margins of adjacent carpels still remain united, the ovary may become one-celled though still compound, as in the violet. The placenta will in this case be *parietal* (on the walls). In certain families (Caryophyllaceæ, Primulaceæ) the compound ovaries are one-celled but have a *basal placenta*, or this basal placenta may project upward into the single chamber of the ovary as a central post on which the ovules are borne (*free-central placenta*) (Fig. 1515). To determine the number of carpels in a given pistil is often difficult. If there are several separate stigmas or styles, it is usually safe to infer that each represents a carpel. If the ovary is several-celled, each cell usually denotes a carpel and in one-celled ovaries the placentæ, if parietal, denote the number of carpels. In the case of a pistil with a one-celled ovary, basal placenta, one style and one stigma, only developmental or phylogenetic studies will show how many carpels are present.



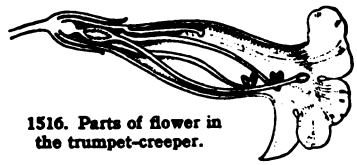
1514. Structure of flower.—The plum.

se. sepals; *p.* petals; *sta.* stamens; *o.* ovary; *s.* style: *st.* stigma. The pistil consists of the ovary, style, and stigma. It contains the seed part. The stamens are tipped with anthers, in which the pollen is borne. The ovary, *o*, ripens into the fruit.

Ovaries are sometimes raised on a stalk within the flower, as in the caper family (*gynophore*) and in Coptis (*thecophore*). The styles and stigmas are frequently much modified for pollination purposes, as in the orchids and in the pitcher plant (Sarracenia).

The andrœcium (Figs. 1520–1522).—Surrounding the pistils are found one or more whorls of organs called *stamens*, collectively termed the *andrœcium* (male household). A stamen normally consists of a slender stalk (*filament*) capped by an enlarged part (*anther*), although this stalk is often wanting. The anther contains one, two or four cavities (locules or "cells") in which a powdery mass (*pollen*) is located. The so-called cells are not to be confused with the cells of the plant tissue. The gynœcium and andrœcium, which are both necessary for the production of good seed, are termed the *essential organs* of the flower. Ordinarily each stamen represents one foliar unit. When many stamens are present, this increase in number is brought about in one of three ways: by an increase in the number of whorls of stamens (Caryophyllaceæ, Rosaceæ) or an increase in length of the spiral (Ranunculus), by the conversion of petals into stamens, or by a breaking up of each individual stamen into many (St. John's-wort). The first method is by far the most common. In the last method, the origin is usually betrayed by the aggregation of the stamens in fascicles. Normally both filament and anther of each stamen is free from its neighbors, but in some cases the filaments are all joined into a tube around the pistil (*monadelphous*) as in the hollyhock, or into two groups (*diadelphous*) as in the pea family. These two groups are usually very unequal in the pea tribes, nine stamens being united while the tenth is free. In other cases the anthers may be coherent while the filaments are free (*syngenecious*), as in the Compositæ. In the Sterculiaceæ, the filaments or tube of filaments are variously toothed, crested or otherwise modified; while in the Orchidaceæ they are fused with the style to form the so-called *column* or *gynandrium* of the flower. In the milkweeds, each stamen bears a cornucopia-like appendage which together form the *crown*. In Viola, two of the filaments bear nectar-spurs.

1515. Section of a flower of corn-cockle.
Showing torus, ovary, styles, stamens and floral envelopes.

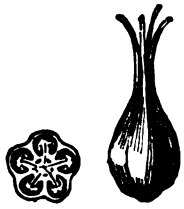


1516. Parts of flower in the trumpet-creeper.

1517. Compound pistil of catnip.
Showing 4-parted ovary, long style, 2 stigmas (*s*).

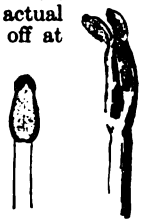
1518. Head of simple pistils in hepatica.

The anthers are usually oval or oblong bodies fixed to the filament by the base (*basal*), or by the center (*versatile*). At maturity they contain normally two pollen-sacs separated by a sterile tissue (*connective*) which is a prolongation of the filament. The anther-sacs are sometimes four in number, sometimes reduced to one through fusion. The walls of the sacs contain a peculiar fibrous layer by the hygroscopic properties of which they are enabled to curve back, thus opening the pollen-chamber along definite prearranged lines and allowing the pollen to escape. The dehiscence is usually by a longitudinal slit, but it is frequently by terminal pores as in the Ericaceæ, or rarely by transverse slits. In Vaccinium, the pores are carried aloft on long tube-like extensions of the anther, while in Berberis the pores are provided with an uplifting trap-door.



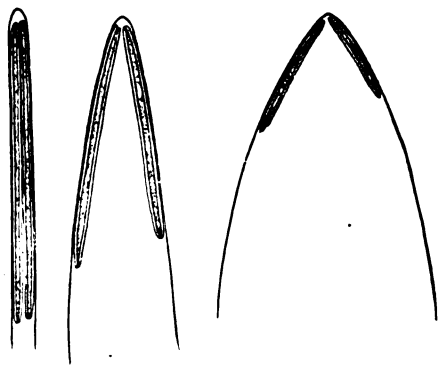
1519. Compound pistil of a St. John's-wort. It has five carpels.

The pollen-grains are normally spherical or oval cells in which the two or three nuclei representing the male gametophyte are found. The wall consists of a delicate inner layer (*intine*), surrounded by a thicker cutinized layer (*exine*) which is either smooth or externally sculptured in various ways. Specialized places in the extine serve as germ-pores through which the pollen-tubes easily emerge. These pores are sometimes provided with actual lids (pumpkin and squash) which pop off at the proper time. The pollen in the Orchidaceæ and Asclepiadaceæ is more or less waxy and coheres into one or several masses (*pollinia*). The pollinia are in many cases produced into minute stalks which connect with a sticky gland that is designed to become attached to visiting insects. On the departure of the insect the gland, together with the attached pollinia, is carried away to the next flower. The pollen-grains of orchids, heaths and a few other plants are composed of two to four cells (*compound*).



1520. Anthers, showing dehiscence; azalea on left, barberry on right.

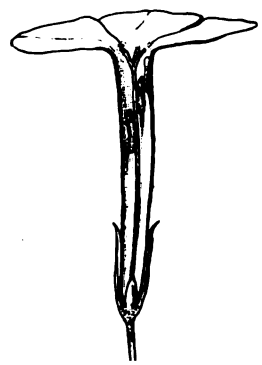
Corolla (Figs. 1523–1527).—Outside the stamens is found a whorl of flat leaf-like usually colored organs termed *petals* or collectively the *corolla*. The petals are usually in one whorl and follow the numerical plan of the flower closely; rarely are they fewer or numerous. They are normally flat or concave colored bodies distinct from one another (*polypetalous*) and regularly spreading from the receptacle. But in many plants the petals are connate (*gamopetalous*) into one structure for a greater or less distance toward the apices. The united part is the *tube*, the lobed border the *limb* of the gamopetalous corolla. The lobes or segments are either all alike and equally placed (*regular corolla*) or they vary much among themselves (*irregular corolla*). If the lobes



1521. Transitions from stamens to petals in the water-lily.

are united higher up into groups of two and three, as in many mints, the upper more or less erect, the lower spreading, the corolla is *bilabiate* (Fig. 1526). A particular type of irregular polypetalous corolla is the so-called *papilionaceous corolla* (Fig. 1527) found in the pea

1522. Stamens of erica (left) and vaccinium.



1523. A salver-shaped corolla.

family and consisting of a *standard*, two lateral *wings*, and a *keel*. A regular corolla is radially symmetrical, possessing an infinite number of planes of symmetry (*actinomorphic*), while most irregular flowers possess but one plane of symmetry (*zygomorphic*). A few possess no such plane (as Canna). Gamopetalous corollas fall into certain types based on the shape of the tube and limb. The more common types are *rotate*, *salverform*, *funnelform*, *bell-shaped*, *tubular*, and *urceolate*.

1524. Funnelform corolla of morning-glory.

The corolla may be variously colored. White flowers owe their color to light reflected from air which is between the cells of the petals, as shown by the fact that when waterlogged these petals become transparent. Yellows and oranges are usually due to abundant minute color bodies (*chromoplasts*) located within the cells of the petal. Reds and blues are due to colored cell-sap.

Calyx.—Surrounding the corolla is another set or whorl of organs, the *calyx*, the individual organs of which are *sepals*. The calyx is usually composed of as many sepals as there are petals, but in the Portulacaceæ there are but two sepals, while in some plants there are many. In many of the Ranunculaceæ and other families they are colored like petals and replace these organs. In the Easter lily and tulip they are similar to the petals. In the Compositæ the calyx is reduced to scales or bristles or is absent entirely. The sepals are frequently connate (*gamosepalous*), and the resulting structure is often irregular. The calyx and corolla are together termed the *floral envelopes*. If they are similar in appearance, and, therefore, difficult to recognize, as in the Easter lily, they are collectively termed *perianth*.

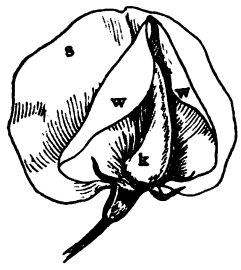
Disk (Figs. 1528, 1529).—In many plants a glandular *disk*, or series of glands corresponding to such a disk, is found. When present, this disk may lie either between the stamens and pistil (*intrastaminal*) as is the common case, or more rarely between the stamens and petals (*extrastaminal*). The genus Acer is

1525. Rotate corolla and connivent stamens of solanum.

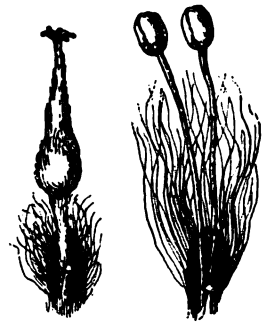
peculiar in having some species with an intrastaminal disk while in others it is extrastaminal. By some morphologists this disk is considered a fifth set of organs in the flower, while by others it is considered merely as an outgrowth of the floral axis or receptacle on which all other parts of the flower are inserted. The disk is in many cases characteristic of whole families, which led Bentham and Hooker to place these families together in the series Discifloræ. The disk also occurs in other families not obviously related. It forms a ring about the styles in some Rubiaceæ. The glandular cup of Populus and the finger-like gland of Salix are probably to be referred here, although by some they have been interpreted as a reduced perianth. The disk usually functions as a nectary. In shape and structure it is very diverse. It may be cup-shaped, saucer-shaped, annular, regular, or irregular; or it may be of separate glands, either simple or variously lobed. It may line the cup of the perigynous flower or it may be adnate to the surface of the ovary.

1526. Labiate corolla of salvia.

Receptacle (Figs. 1530, 1531).—The apex of the stem on which the various floral organs are inserted is termed the *receptacle* or *torus*. This is normally a simple club-shaped thickening of the summit of the stem. In the strawberry it is much enlarged and fleshy,



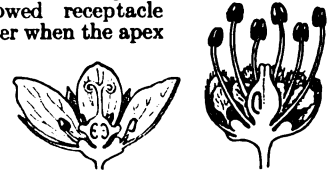
1527. A papilionaceous corolla.—The sweet pea. *s*, standard; *w*, *w*, wings; *k*, keel.



1528. Showing the disk in the willow flower. Pistillate flower at *a*; staminate flower at *b*.

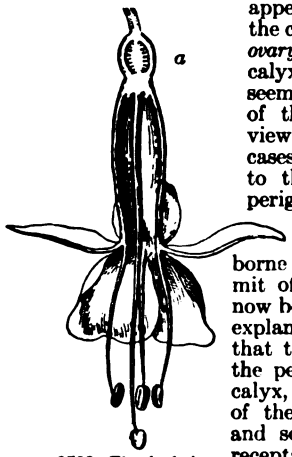
forming the greater part of the fruit. In the raspberry it remains on the plant when the "fruit" is removed. In the Compositæ there is a common receptacle for all the flowers of the head, as well as for each individual flower. In the caper family the receptacle is often prolonged upward, forming a stalk for the ovary within the flower (*gynophore*).

In the Rosaceæ, Onagraceæ, Saxifragaceæ, and in various other plants, the stamens, petals and sepals are *perigynous*, that is they are inserted on the edge of a cup-shaped organ which springs either from below the ovary or from its summit. The view has been held that the gamosepalous calyx here bears the stamens and petals on its tube. Another early proposed view has in recent years gained ground rapidly and is now widely accepted. This view interprets the cup as a hollowed receptacle likened to a glove-finger when the apex is slightly pushed in. The ovary at the bottom of the cup is really apical as usual, while the sepals, petals and stamens, located at the higher margin of the cup,



1529. Disks in flowers of maple family.

are as usual inserted morphologically lower on the receptacle. While in most flowers the ovary is inserted on the summit of the receptacle (*superior ovary*), in others, as in the Orchidaceæ, Onagraceæ, Umbelliferæ, Rubiaceæ, and Compositæ, the ovary appears to occupy the center of the club-shaped structure (*inferior ovary*) below the insertion of the calyx, corolla, and stamens which seem to spring from the summit of the ovary (*epigynous*). The view has been held that in such cases a gamosepalous calyx similar to that described above in the perigynous flower has grown fast to the surface of the ovary, and that the other organs are borne on the calyx-tube at the summit of the ovary. The opinion is now becoming general that the true explanation of the phenomenon is that the cup-shaped receptacle of the perigynous flower, and not the calyx, has grown fast to the surface of the ovary. In the Onagraceæ and some other plants, the hollow receptacle has not only grown fast to the whole surface of the ovary but projects beyond it so that such flowers have an inferior ovary and are also perigynous (Fig. 1530).



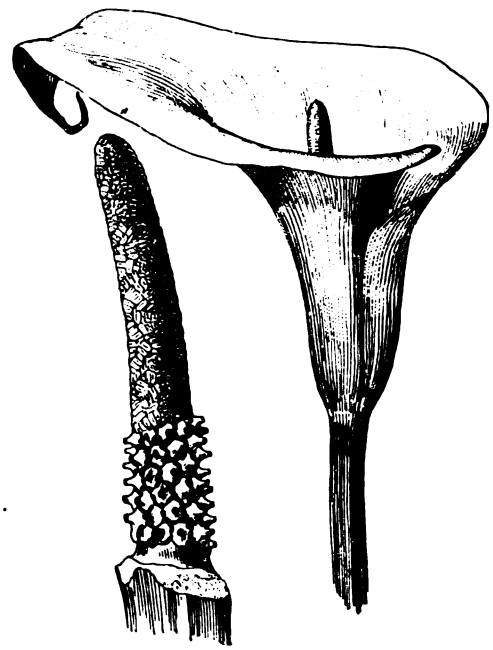
1530. The fuchsia flower in longitudinal section.

Bracts.—The leaves on the peduncles and upper parts of the stem adjacent to the flower deserve a word. They are often much modified in size, shape and color from the normal foliage leaves, being often much reduced. They sometimes form an involucre around the flower, and are calyx-like, as in hepatica and strawberry. In other cases, they form a showy corolla-like involucre, as in Cornus and Poinsettia, and are then often mistaken for a corolla. In the Arum, a single huge bract (*spathe*) envelopes the entire flower-cluster (*spadix*); these are well shown in Figs. 1532, 1533.

1531. *a*, epigynous flower; *b* and *c*, perigynous flowers.

Incomplete flowers.—Not all of the floral sets described above are always present. The flowers may be *incomplete*. Thus the corolla may be wanting (flower *apetalous*) as in hepatica and anemone, or both calyx and corolla may be absent (*naked* or *achlamydeous*) as in willow and pepper, or the stamens may be wanting (*imperfect* or *unisexual*, pistillate flower) as in willows and oaks, or the pistils may be absent (*staminate* flowers of willows and oaks). At least one set of essential organs is necessary for a functional flower, but in some cases, through specialization for other purposes, both sets may be absent. Thus the marginal flowers of the hydrangea are enlarged and showy for insect attraction, but are *neutral*. In the case of unisexual flowers, the stamens and pistils may be borne in different flowers on the same plant (*monœcious*) as in the oak and birch, or on separate plants (*diœcious*) as in the willow and poplar. In some plants, as in the maple, certain flowers are unisexual while others are perfect, a condition termed *polygamous*.

The plan of the flower.—If the numbers of parts in each set are counted, a certain number will be found to be common to many or all of the sets of the same flower. This is the *numerical plan* of the flower (Fig. 1534). Thus in geranium there are five sepals, five petals, ten stamens, and five parts to the pistil. The stamens, when numerous, are often in multiples of this numerical plan. The parts of the pistil, on the other hand, frequently show a reduction from the numerical plan as exhibited by other parts of the flower. The number of parts in some flowers is so irregular that a numerical plan can be made out only with difficulty, while in some flowers such a plan is apparently wanting.



1532. The great white spathe (and the spadix) of the garden calla.

The members of each floral set are usually inserted all at the same height on the floral axis (receptacle), and are therefore in whorls, although frequently more than one whorl occurs in the androecium and rarely in other sets. The parts of one set normally fall between those of the set next outside and next inside, and are said to alternate with these. In some families, as for example in the Ranunculaceæ and Magnoliaceæ, some or all of the organs of the flower are inserted spirally on the receptacle like scales on a pine cone. In such cases there is often a marked intergrading between the organs of the adjacent sets at the boundary line. The relative position of parts of the flower may be graphically indicated by means of a diagramatic cross-sectional plan, called the floral diagram (see Fig. 1534.). Information in regard to the number and union of parts may also be indicated by so-called floral formulæ as follows:

$$\begin{array}{cccc} K & \widehat{C} & A & \widehat{G} \\ 5 & 5 & 5+5 & 2 \end{array}$$

In this formula, the letters from left to right indicate calyx, corolla, androecium, and gynœcium respectively. The brackets over the letters indicate a fusion of parts in the same set, while the bracket underneath indicates a fusion of different sets. The above flower would be polysepalous with five sepals, gamo-

1533. Spathe and spadix of Jack-in-the-pulpit.

petalous of five fused petals, have ten stamens in two whorls all inserted on the corolla, and two carpels united into one pistil with a superior ovary.

Double flowers.—Occasionally in nature and very frequently in cultivation, the number of petals becomes very greatly increased, often to the exclusion of the stamens and pistils, so that the flower presents a full rosette-like appearance. Such flowers are popularly said to be "full" or "double." The increase in petals is apparently a mutation, but is stimulated by changes in nutrition due to cultivation. Most double-flowered varieties tend strongly to run out. The origin of the extra petals is not always the same. In most cases, as in double hollyhocks and carnations, the stamens and even carpels have been transformed into petals; in rarer cases the extra structures are interpolated organs. Double "flowers" in the sunflower, golden glow, and the like, are simply heads in which all disk-flowers are converted into ray-flowers (see next paragraph).

False flowers of the Compositæ (Figs. 1535, 1536).—The so-called flowers of such plants as the white daisy, sunflower, aster, goldenrod, and dandelion are found on close study not to be flowers at all, but flower-clusters of the type termed *heads*. These heads are remarkably specialized for economy and division of labor. This community of flowers functions as does one individual flower in other cases, and the whole make-up of the head simulates a flower to a remarkable degree. Around the head is a calyx-like involucre of bracts, functioning like a calyx as a protection in the bud. In

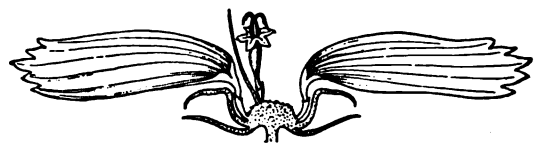
1534. Diagrams of the flower of drosera, viscia and viola.

daisy, sunflower and others there is a corolla-like part consisting of highly modified *ray-flowers* or *ligulate flowers*. The central part of the head in these plants is occupied by *disk-flowers*. The aster, goldenrod, coneflower and many others are like the daisy, while in the dandelion, chicory, hawkweed and sow thistle the head consists of ligulate flowers only, and in the thistle, boneset and iron weed the head contains only disk-flowers. The morphology of the less specialized disk-flower is as follows: A one-celled, one-seeded inferior ovary is surmounted by a variously modified calyx, which is often wanting, and a tubular five-toothed gamopetalous corolla. On the corolla-tube are borne five syngenesious stamens, and from the summit of the ovary projects a single style which is two-branched above. The ray-flowers have been developed from the disk type in the course of evolution by greatly increasing the size of such a tubular corolla, and by splitting the tube down one side, at the same time flattening out the slit portion. In the sunflower, there was no great change in color as the ray-flowers evolved, while in the daisy and the asters the rays are of a different color from the disk-flowers. Since the involucre performs for the whole head the same function that the individual calyx does normally for each flower, there is no longer any necessity for the calyx. Therefore, following the general rule that a useless structure tends either to disappear or take on a new function, the calyx has become obsolete in some cases while in others it has become modified into scales, awns or bristles (*pappus*) which aid the fruit in dissemination. In many cases the ray-flowers have been sacrificed entirely for insect attraction and have become sterile. By this massing of the flowers, more flowers may be pollinated by one insect visitor, and more easily pollinated. Efficiency and economy run through the whole organization of the composite head to a remarkable degree.

The biology of the flower.—The flower is a structure developed by plants to promote and safeguard sexual reproduction, primarily in land plants, and to bring about cross-pollination in these plants. The three definite agents of cross-pollination with which the flower is concerned are water, wind and insects. The agent for which the flower is adapted exerts a profound influence on the structure of the flower. Only insect-pollinated flowers are normally showy. Water- and wind-pollinated flowers are usually green and small, with often a total loss of corolla or of both corolla and calyx. The pollen in such plants is produced in abundance to make up for great loss, as it is wafted indiscriminately through the air. Water plants usually flower at the surface and are wind- or insect-pollinated. The true water-pollinated or hydrophilous plants are few in number. Naias, Zannichellia, Zostera and Ruppia may be mentioned, all of which belong to the Naiadaceæ. In Zostera, the pollen-grains are long and spiral as a further adaptation to water-pollination.

1535. Head of composite, showing receptacle at *e*, bearing the disk-flowers. The long rays are shown, and beneath them the hairy involucre.—Rudbeckia.

Wind-pollinated or anemophilous flowers (Figs. 1537, 1538) are very numerous. Elodes and Vallisneria (eelgrass) among aquatic plants may be mentioned. Vallisneria is remarkable because the staminate flowers break off before anthesis, rise to the surface, expand, and are floated about by the wind, the three reflexed sepals acting as floats which cannot be upset. The pistillate flowers are attached to long peduncles which extend to the surface of the water, whether it is shallow or deep. The pistillate and staminate flowers are so shaped that when the two float together the stamens are in exactly the right place to touch the stigmas. After pollination, the peduncle coils up and the fruit matures under water. The catkin-bearing trees are all anemophilous and have very much reduced flowers. The willows are both wind- and insect-pollinated. Among herbs the grasses, sedges, rushes, and sorrels (Rumex) are wind-pollinated. Interesting in this respect is Thalictrum (meadow-rue) of the Ranunculaceæ, the flowers of which are wholly green and insignificant with large exserted anthers and abundant pollen and feathery stigmas. It thus exhibits perfectly the various adaptations to wind-pollination in a family that is normally insect-pollinated and has showy flowers. The time of flowering of wind-pollinated flowers often shows



1536. Parts in the head of a coreopsis.

a distinct relation to efficiency. The wind-pollinated trees and shrubs bloom in early spring before the leaves interfere with the passage of pollen through the air. The grasses and other herbaceous anemophilous plants bloom before the tall growth of late summer has matured, at which time plants are mostly insect-pollinated. The pollen-grains of anemophilous plants are nearly always smooth and very light, and usually con-

tain starch as a reserve food instead of oil. This pollen is capable of withstanding greater desiccation than is the pollen of most insect-pollinated flowers. In the pines, each grain is provided with two air-sacs to increase the buoyancy and to expose greater surface to the wind.

1537. Wind-pollinated flower of juncus. (Enlarged)

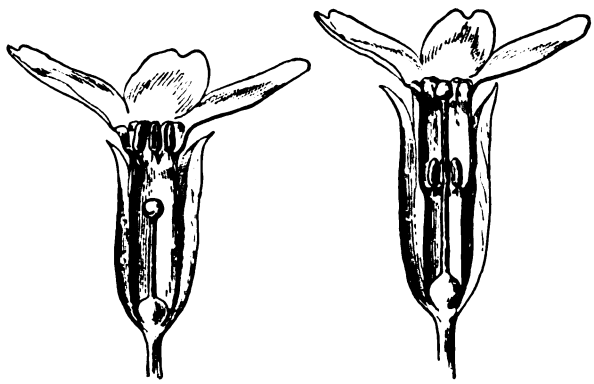
Insect-pollinated or entomophilous flowers must meet two distinct problems: they must entice the insect to the flower; and they must guide the insect in such a way that cross-pollination will be assured. The attractive agents are four in number,—color, honey, scent, and abundant pollen (for pollen-eating insects), but they are not usually all found in one species. Color is provided mainly by the corolla, but the calyx (in Anemone) or even the bracts around the flowers (in Cornus and Poinsettia) may function thus instead. Attempts have been made to show that certain colors are more attractive than others to certain groups of insects. Yellow has been designated as the color for flies and beetles, blue and red for hymenoptera, browns for carrion insects and wasps, and whites for night-flying insects especially. Honey (nectar) is produced in a great variety of flowers and it is a reward for the insect visit. The honey-secreting glands (nectaries) are borne either on the disk or on the petals, but more rarely are they staminal or ovarian. In order that the honey may not be appropriated by undesirable insects which would not effect cross-pollination, it is frequently placed at the end of spurs or grooves which are adapted to the proboscis of the insects for which the flower is adapted. Various markings of the corolla, such as bright eye-spots and dark converging lines, called honey-guides, often direct the insect accurately to the honey, and in such a way that cross-pollination will be accomplished. An interesting case is the violet, where the honey is produced by staminal nectaries but is collected and stored in the spur of the lower petal. To this storehouse honey-guides in the form of purple lines lead. The beard in the throat of the violet flower protects the pollen from rain and also discourages the insect from entering the flower on the wrong side. Scent as a means of attracting insects is very general, and is especially frequent in nocturnal and crepuscular (twilight) flowers. The scent is due to volatile oils produced mainly by the petals. These oily compounds are comparatively few in number and often re-occur in plants that are wholly unrelated. Thus the clove scent is found also in some orchids, and the violet scent is found with slight modification in the flowers of several plants. Flowers that attract pollen-eating insects are often yellow, as buttercups and dandelion, but flowers of other colors are frequently visited at least by bees that carry away quantities of pollen in their femoral pollen-pockets.

1538. Wind-pollinated flower of a grass. —Poa. (Enlarged)

Most pollen is injured by exposure to rain and dew. The grains tend to swell and burst owing to the excessive osmotic pressure. It is for this reason that pollen when studied or germinated in the laboratory must be mounted in a sugar solution approximating the density of the stigmatic fluid. It is not a surprise, therefore, to find that nature has protected the pollen of many flowers from rain, by structural means. Thus, bell-shaped hanging flowers, salverform corollas with a small eye which requires pressure to force a drop of water in, closed corollas of the snapdragon type, beard in the throat, flowers that droop only in wet weather, flowers that close up during rain, and many other contrivances, are adaptations, in part at least, for the protection of the pollen.

The protection of the honey and pollen from unbidden insect guests and the safeguarding of the flower from self-pollination by such insects, has led to various protective devices. The closed throat of the toadflax and snapdragon, the small eye of the salverform corolla, the beard in the violet, setose peduncles and stems over which insects can walk with difficulty, glandular peduncles and bands of viscid matter which serve as a sort of sticky fly-paper to prevent wingless insects from reaching the flower, are all adaptations of this nature. Remarkable in this respect is the teasel, which has connate-perfoliate leaves. These leaves form a basin around the stem at each node. The basins fill with water during each shower, and, as the water will not evaporate for several days, there is a veritable moat around the stem at each node which climbing insects cannot pass.

Cross-pollination is frequently rendered more certain by various mechanical devices. Thus a device of



1539. Dimorphic flowers of primula.

great efficiency found in many plants is the separation of stamens and pistils in different flowers (*diclinism*) which renders self-pollination impossible. In this respect, the dicœcious plant is the most perfect type. Diclinism is especially common in anemophilous plants, in which the pollen is blown about indiscriminately. Another efficient device consists in the early maturation of the stigmas (*proterogyny*) or of the stamens (*proterandry*) before the other sex in the same flower (condition of *dichogamy*). Still another, although much less common device, is the production of two or three types of flowers in the same species in which the styles and stamens are of different lengths (*heteromorphism*). Thus in the primrose (Fig. 1539) one flower may have long stamens and short style, and another flower short stamens and long style (*dimorphic*), so that an insect coming from a long-stamened flower will have pollen on his proboscis at exactly the right height to brush the stigma of the long-styled flower. In *Lythrum Salicaria*, the various combinations between the length of style and of each of the two sets of stamens furnish three types of flowers (*trimorphic*). Other devices are often found. Thus in some flowers the pollen of another plant is prepotent in fertilization over that of the same plant if both are placed on the stigma at the same time. There are also many special structural mechanisms in individual species, a study of which forms one of the most interesting chapters in biology. Here may be

mentioned the wonderful adaptations of the orchid flowers, the catapulting of the pollen of the orchid Catasetum against the insect, the lever-hammering stamens of Salvia, the deliberate stuffing of the Yucca stigma with pollen by the Pronuba moth as she deposits eggs in the ovary, the gall flowers and caprification of the fig, and many other equally extraordinary cases.

Although most plants seem to need cross-pollination and to have structures adapted to this end, there are some in which definite preparation is made for close- or self-pollination. Thus certain plants, as violet, barley, Polygala, Dalibarda (Fig. 1217) and others, produce *cleistogamous flowers*, which are small green apetalous structures often hidden by the leaves or are even subterranean. The calyx of these flowers never opens. The anthers lie against the stigma, and on opening, the pollen is immediately applied to the stigma of that same flower. Seeds produced by such flowers are often much in excess of those produced by the showy flowers of the same species. In the violet (Fig. 1540), cleistogamous flowers are produced in abundance through the summer after the showy flowers have disappeared. Incidentally it is interesting that these flowers in violets are more important in classification than are the showy ones.

Evolution of the flower.—In the Thallophyta, Bryophyta and Pteridophyta there is no flower as that term is here used. The sporophyte shows an increasing complexity through these groups, but there is no differentiation into an organ that could popularly or even technically be called a flower. Among the Gymnosperms, the cones of the Pinaceæ have been likened to a flower with many carpels but with no calyx or corolla, while those of the Gnetaceæ are still more flower-like. The true flower, however, is a structure characteristic of the Angiosperms.

There are two prominent theories in regard to the origin of the flower. First, the foliar theory holds that sepals, petals, stamens and carpels are real leaves modified in the course of evolution from the foliage-leaves of their ancestors. Floral parts are, therefore, metamorphosed leaves. The evolution in this case would have been from below toward the apex of the floral shoot, or from the foliage leaves toward the carpels. Certain teratological conditions have been cited in support of this theory, especially when petals, stamens and sometimes carpels have been replaced by green leaves. This has been considered merely a reversion to ancestral conditions. *Trillium grandiflorum* frequently furnishes cases of this sort. This theory has been exclusively held in the past. Recently another wholly different theory has been proposed by Bower, and is now accepted by very many botanists. This has been termed Bower's sterilization hypothesis. It holds that the foliage-leaves together with the sepals and petals are sterilized sporophylls and that evolution has been from above downward. Specifically it holds that although the simple sporophyte of the mosses consisted as at present of a capsule and seta undifferentiated into stem and leaves, in some special groups of mosses, however, the spore-bearing region around the columella of the capsule became segmented into transverse belts separated by sterile belts. Coincident with this, the exterior of the capsule became lobed in such a way that each fertile belt came to lie in the axil of a lobe. From this it is easy to postulate an increase in size of the lobes to form the scale-leaves of the club-mosses and selaginellas, and an increase in specialization of the fertile belt to form the axillary sporangium of these plants. It is but a step now to the angiospermous flower, in which some of the sterile sporophylls have become modified into petals and sepals instead of leaves. The demand for a large independently growing sporophyte is thought to have led to the sterilization of the sporophylls. According to this theory, leaves are recent rather than primitive structures. The sterilization theory has the advantage of being more in accord with modern knowledge of the evolution of organs in these groups.

Floral evolution within the angiosperms is also difficult to follow and botanists differ as to its course. It is by many held that the most ancient type is the acyclic type as represented by the Ranunculaceæ, Magnoliaceæ and the like. Another although gradually diminishing school holds that the simple flowers of the Gramineæ among the monocotyledons and the Amentiferæ among the dicotyledons are the most primitive. The high specialization of other parts of these plants and the likelihood that the flowers have been simplified because of the adoption of the wind method of pollination, strongly suggests that these flowers are not primitive but specialized.

The flower from standpoint of comparative morphology.—The newer evolutionary morphology has brought about changes in viewpoint in regard to floral parts, and a new terminology has arisen. According to present knowledge, there is in some algæ and in all bryophytes, pteridophytes and spermophytes a definite alternation of two generations or phases in the life-history of each plant, separated by a unicellular condition of the organism. One of these, the more primitive, bears only sex-cells (eggs and sperms) called *gametes* and is termed the *gametophyte*, while the other bears spores only and is termed the *sporophyte*. These generations have exactly reversed their relative size, complexity and degree of independence as evolution has progressed. The originally independent carbon-assimilating gametophyte of the mosses has become in the higher plants wholly parasitic on the sporophyte and is entirely lacking in green color. On the other hand the sporophyte, represented in the mosses and liverworts by the dependent capsule and seta stalk, has become the real plant, bearing leaves and flowers in the higher group. The thalloid reduced gametophyte of the ferns is termed a *prothallium*, bearing sperm-cells in *antheridia* and an egg-cell in an *archegonium*. This prothallium has become differentiated in the more specialized family Selaginellaceae into two types differing in size and complexity of structure, and originating from spores of different size. The large type of spore (*megaspore* or *macrospore*) gives rise to the large female prothallium which bears the archegonia; and the small spore (*microspore*) gives rise to the small male prothallium bearing only a single antheridium. The prothallia of both sexes are very much reduced and permanently inclosed within the spore wall. In the flower-bearing plants, the reduction and dependence of the gametophyte have been carried much farther. The male gametophyte or

1540. Common blue violet.
The familiar flowers are shown, natural size. The corolla is spurred. Later in the season, cleistogamous flowers are often borne on the surface of the ground. A small one is shown at *a*. A nearly mature pod is shown at *b*. Both *a* and *b* are one-third natural size.

male prothallium is inclosed in the pollen-grain and the female prothallium within the embryo-sac. The spore-bearing chamber or chambers (*sporangia*) corresponding to the capsule in the mosses are borne on leaves (*sporophylls*) in the ferns and fern allies. If these terms used for the mosses and ferns are now applied to the organs of the higher plants the terminology will be as follows: Stamens, *microsporophylls;* anther-chambers, *microsporangia;* pollen-grain, *microspore;* nuclei within pollen-grain, *male prothallium* (male gametophyte); carpel, *megasporophyll;* ovule, *megasporangium;* embryo-sac, *megaspore;* cells within embryo-sac except embryo, *female prothallium* (female gametophyte); the embryo growing from the fertilized egg is the *daughter sporophyte.* A mature seed, therefore, contains parts of three generations; seed-coats and nucellus, if present = sporophyte; endosperm (according to one interpretation) = gametophyte; and embryo = daughter sporophyte. This terminology is now gaining ground over the old in morphological circles for it shows the relation of the flower to organs in the lower groups. K. M. WIEGAND.

FLOWER-DE-LUCE. The origin of the Fleur-de-lis of the French coat of arms is not known. By some it is supposed to represent the head of a spear, by others the flower of a lily. It has also been derived from the points of a crown and from several animal forms, as bees and toads. Apparently, the iris has nothing to do with the heraldic Fleur-de-lis. This name as applied to iris is of later origin and of a purely botanical significance, referring chiefly to *I. germanica.* See under "Fleur," Larousse, Dictionaire du XIX Siècle, 8:450. H. HASSELBRING.

FLOWER-FENCE, BARBADOES: *Poinciana pulcherrima.*

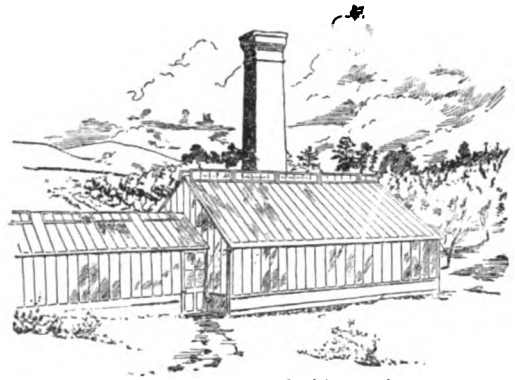
FLOWER-OF-AN-HOUR: *Hibiscus Trionum.*

FLOWERING MAPLE: *Abutilon.*

FLÚGGEA (for Fluegge, a German botanist of early 19th century). *Euphorbiàceæ.* Tropical shrubs, sometimes cult. in the greenhouse: lvs. alternate, simple, entire: fls. apetalous, the staminate in axillary clusters, with imbricate calyx and rudimentary pistil, the pistillate borne singly, and with a lobed disk present, styles slender—ovules 2 in each of the 3 cells: seeds grooved on the inner face.—Six species in the Old World tropics. Related to Phyllanthus. One species, *F. leucopỳrus,* Willd., with orbicular to obovate lvs. and edible white berries has been intro. to cult. in Eu. It is a bushy shrub from Asia south to Austral. and is said to need rich mold and moist high temperature. Prop. by cuttings. J. B. S. NORTON.

FŒNÍCULUM (diminutive from the Latin for *hay,* because of its odor). *Umbellíferæ.* About four species of annual, biennial and perennial herbs, spread from the Canaries to W. Asia, one being the FENNEL of gardens (which see). Glabrous, often tall: lvs. pinnately decompound, the segms. linear or filiform: fls. yellow, in compound umbels, the calyx-teeth obsolete, the petals broadish, emarginate: fr. oblong or ellipsoidal, not laterally compressed, the carpels half-terete, ribbed and flattened. **F. vulgàre,** Hill (*F. officinàle,* All. *F. Fœnículum,* Karst.), of S. Eu., the fennel, is a perennial of short duration, cult. as an annual or biennial for its aromatic seeds and lvs.: erect and branched, 3–5 ft.: lvs. 3–4 times pinnate, the ultimate segms. very narrow and thread-like and rather stiff in the wild and in dry places but very slender when cult., the petioles broad and clasping: umbels large, of 15–20 or more rays. Often run wild.—Under cult., the petiole has become broad and sheathing and other changes have taken place. What are considered to be horticultural forms have been described as distinct species: var. **piperìtum,** Hort. (*F. piperìtum,* DC.), the carosella of S. Italy, the young sts. of which, inclosed in the sheathing petioles, are eaten raw in the early season; var. **dúlce,** Alef. (*F. dúlce,* Mill.), the finocchio or Florence fennel, a low-growing condensed plant, with very large lf.-bases. L. H. B.

FOKIÈNIA (named after the Chinese province Fokien where the tree grows). *Pinàceæ.* A tree intermediate in its characters between Chamæcyparis and Libocedrus, resembling the latter in the foliage and in the seeds having 2 very unequal lateral wings; the cone is subglobose and composed of numerous peltate scales, each bearing 2 seeds.—One species in Fokien. **F. Hódginsii,** Henry & Thomas (*Cupréssus Hódginsii,* Dunn). Tree to 40 ft.: branchlets much flattened, the lateral lvs. with spreading acute apex, green above and with white markings below: cone 1 in. long, ripening the second year. G.C. III. 49:66, 67.—Suited only for cult. in warmer temperate regions. ALFRED REHDER.



1541. House constructed without rafters.

FOLIAGE PLANTS. A term used to designate plants that are grown for the general effect of their foliage rather than for their flowers. The term is indefinite. In some cases, and more correctly, it is used for plants with unique or interesting leaves—usually colored—as coleus, Rex begonia, peperomia, calathea, farfugium. In other cases it is used to designate plants of full foliage and graceful habit,—plants that are prized for their general habit quite as much as for the characters of the individual leaves. Of this latter class, ferns, palms, grevillea, screw pine, araucaria, fatsia, ricinus, are leading examples. The latter class contains the most popular commercial subjects, and they are much used in room and table decorations. The plants are often rented for use in temporary decorations. For the culture of foliage plants, refer to the various genera.

FONTANÈSIA (after Réné Louiche Desfontaines, prominent French botanist, 1752–1833, director of the botanical garden at Paris). *Oleàceæ.* Shrubs grown for their handsome foliage.

Deciduous, glabrous: branches quadrangular: lvs. opposite, short-petioled, entire: fls. perfect, small, in axillary clusters forming terminal leafy panicles; calyx minute, 4-parted; petals 4, narrow, small; stamens 2, exceeding the petals; ovary superior, usually 2-celled; stigma 2-lobed: fr. a flat, winged nutlet.—Two species in W. Asia and China.

These are slender-branched shrubs with rather narrow leaves and small whitish flowers in short terminal panicles. They retain the foliage unchanged until late in fall, and are well adapted for shrubberies, growing in any good garden soil. *F. Fortunei* is hardy as far north as Massachusetts, *F. phillyræoides* only half-hardy. Propagation is readily effected by greenwood cuttings under glass in early summer; also by layers and by seed.

Fórtunei, Carr. (*F. phillyræoìdes* var. *sinénsis,* Debeaux. *F. califórnica,* Hort.). Shrub, to 15 ft.: lvs. lanceolate or ovate-lanceolate, acuminate, shining, quite entire, 2–4 in. long: fls. in axillary and terminal clusters, forming a narrow, leafy panicle: fr. broad, oval or ovate, ¼–⅓in. long. May, June. China. R.H. 1859, p. 43.—Sometimes united with the following, to which it is superior by its more vigorous growth, the darker and larger foliage, and by the greater hardiness. In China it is used as a hedge plant and may be recommended for trial in this country.

phillyræoìdes, Lab. Shrub, to 10 ft.: lvs. ovate-lanceolate or narrow-elliptic, mostly with rough, minutely denticulate margin, 1½–2½ in. long: fls. and frs. like those of the preceding species. W. Asia. L.B.C. 14:1308. Var. **angustifòlia,** Rehd. (*F. angustifòlia,* Dipp.). Lvs. narrow-lanceolate or oblong-lanceolate.

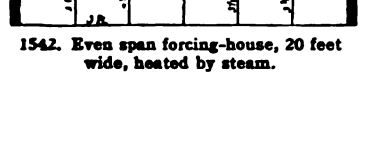
ALFRED REHDER.

FORAGE PLANTS are mentioned only incidentally in this work, as they belong to agriculture rather than to horticulture. They are mostly grasses and leguminous plants, and have a very large special literature, much of which can be secured from the United States Department of Agriculture, Washington, D. C., the various experiment stations, and separate books. Some of the forage plants are of interest to horticulturists as green-manures and cover-crops.

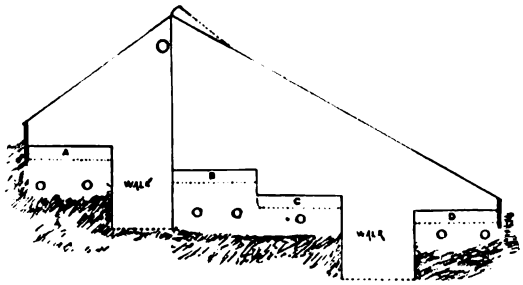
FORCING. The word forcing is variously used. Properly, it should designate the growing of plants outside their usual or normal season. This distinguishes forcing from the ordinary purpose of the glasshouse, which is to imitate the usual season in which plants grow. For example, begonias are not forced: we endeavor to protect them and to give them the season and the conditions under which they grow in the wild. Carnations when flowered in the winter are forced, because we transpose their seasons. Chrysanthemums blooming in October and November are not forced: they are only protected. Sometimes the word forcing is used in a very special sense, to denote the production of flowers from bulbs or tubers in a very short time under the influence of a very high temperature. Thus, the lily-of-the-valley may be placed in a temperature of 90° or above, and the large buds be forced to throw out their flowers before the plant secures a firm foothold on the soil.

A forcing-house is a building in which plants are forced; but the term has come to denote a simple glasshouse in which plants are grown only for sale, in distinction from private conservatories, or more elaborate structures used for the display of plants. See *Greenhouse.*

The forcing industry in America is very large. At first it was confined mostly to cut-flowers (which see), but pot-plants, vegetables and fruits are receiving more and more attention. The staple forced flowers are the rose, carnation, violet, lily-of-the-valley, and various bulbs. These are treated under their respective names. Of vegetables, the most important forcing species is lettuce. This is followed by tomato, cucumber and radish. Other vegetables are of very minor importance as forcing products. The growing of fruits under glass is receiving increasing attention in this country. Very little of this fruit-raising is really forcing, however, since the glass inclosure is used chiefly to protect the plants and to enable better care to be given: the fruit does not ripen much ahead of its normal season. Of this category are glasshouse grapes. Strawberries are really forced, however, the whole period of vegetation and bloom being greatly forwarded. Much attention is now given by florists to the forcing of hardy plants; and this is one of the most delightful of horticultural operations for the amateur. Many of our native plants can be forced with the greatest satisfaction, but the business is usually confined to imported stock of florists' plants.



1542. Even span forcing-house, 20 feet wide, heated by steam.



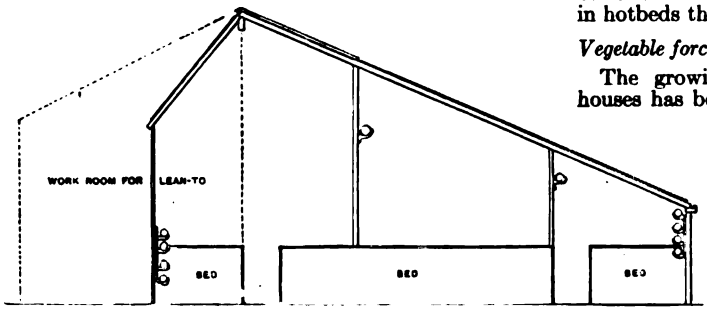
1543. Uneven span forcing-house, 20 feet wide, on a side hill. Heated by steam.

The forcing-house should be of the simplest construction. The plan should secure the greatest amount of light, economy of space and of heating, and directness and simplicity in every operation. The simple sash-bar frame, without rafters (Fig. 1541), is most satisfactory when properly constructed. The side walls should be low and the roof comparatively flat. Often there is no glass on the side walls. Under most conditions, the house should run north and south, particularly if even in span (Fig. 1542), but the lay of the land and the location of existing features usually determine the direction. If the house runs east and west, or if it stands on sloping land (Fig. 1543), an uneven or broken span is usually advisable. The widely different opinions respecting the merits and demerits of the different spans are proof that each is good under certain circumstances. It is the prevailing opinion that, in broken spans, the long roof should be to the south; yet formerly some glasshouses had the short span—which is then very steep—facing the south (Fig. 1546).

In America, all forcing-houses are heated by means of small wrought-iron pipes, which fit together with threads. The old-time cast-iron flues may be employed for conservatories, but they are too bungling for forcing-houses. They do not admit of sufficient modification in layout to adapt them to the long and often crooked runs of forcing-house establishments. The wrought-iron pipes are heated either by steam or water. Each system has its advocates, which means that each has its merits. Steam is less costly to install, since less pipe is required. It also admits of greater variation in the layout. Crooks and obstacles are more easily overcome. In a large establishment, the place may be heated up sooner. Hot water gives a milder heat because the pipes are less hot. Of itself, it is less liable to fluctuations. Theoretically, it is less expensive in fuel; but in practice, the cost of running is found to depend more on the character of the particular system and the operations of the fireman than on the medium itself. When properly installed, steam is as uniform in action as water, and it is adapted to larger areas and to higher temperatures (p. 1403).

Very good shape for a forcing-house in the proportion of breadth to length is probably as 1 is to 4 or 5. The best houses are rarely less than 18 or 20 feet wide, and rarely more than 30 to 35 feet. From 400 to 800 feet is considered to be a good range of profitable length.

Houses of greater length are constructed, but they must be considered as special cases. Parallel houses are often "nested" with good results,—the adjoining houses resting on a common wall. When the various houses are to be used for one kind of crop, the partitions between them may be omitted; a very large space may then be covered with practically one house without the necessity of rearing a high roof. The size of house tends constantly to increase.



1544. Uneven span forcing-house, 30 feet wide. Hot water.

The accompanying illustrations (Figs. 1541–1548) show old and recent styles of American forcing-houses. For further discussion of glasshouses, see *Greenhouse*.

L. H. B.

The forcing of vegetables.

The title "vegetable-forcing" may be applied to any method of growing vegetables which will cause them to mature or to become suitable for use in a shorter time or at a different season than when grown under normal conditions. This includes the growing of vegetables in coldframes, hotbeds and vegetable forcing-houses.

Coldframes.

Coldframes are box-like structures about 6 feet in width and of any desired length. They usually are built to run east and west and with the north side a foot or so higher than the south side. These frames are sometimes covered with muslin but usually with sash in which glass is fastened. The frames serve not only as a protection against cold winds and frost but as a means of catching the sun's rays which may pass through them. In this way, a higher temperature can be maintained in these frames than that which prevails in the open at the same time. Coldframes are used for the purpose of starting crops early and thus growing them to maturity earlier than they can be grown outside, and also for the growing of plants for the field-crops.

Hotbeds.

Hotbeds are similar in construction to coldframes. The chief difference is that in the hotbeds fresh horse-manure is used to supply heat. The manure is firmly packed to a considerable depth, in a pit dug for that purpose inside the frame. Rich garden soil is placed over the manure to a depth of about 6 inches. As the manure ferments, the heat thus formed penetrates the soil above, thus furnishing a satisfactory medium for plant-growth.

Hotbeds are in common use in connection with private gardens in all sections of the country except where freezing weather does not occur. They are used extensively in a commerical way in and near most of the large cities in northern latitudes, and especially such cities as Philadelphia, Cincinnati and St. Louis. Crops are grown to maturity more commonly in hotbeds than in coldframes.

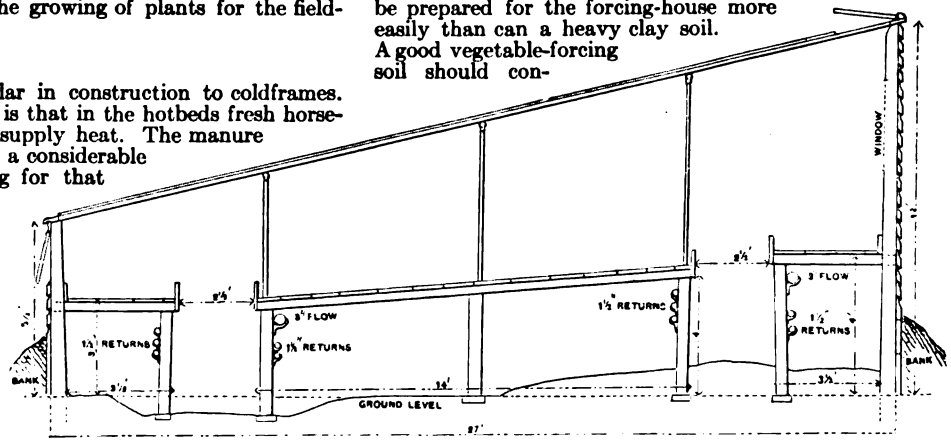
Vegetable forcing-houses. Figs. 1547, 1548.

The growing of vegetables in vegetable forcing-houses has become a very popular and profitable line of work in many sections of the country. The area of glass devoted to vegetables has increased with great rapidity during the last few years. The first section of the country to become noted as a forcing center was Boston, Massachusetts. Soon afterward Grand Rapids, Michigan, became an important vegetable-forcing locality. The Grand Rapids growers did not copy after the Boston growers, however, as their soil, houses, varieties and methods in general differed very materially from those used by the Boston growers.

Vegetable-forcing, as conducted by the Boston growers, was rapidly extended to other places in the eastern part of the United States. The development of the industry was even more rapid and became more extensive in Michigan and nearby states. Grand Rapids methods, with modifications, were followed very largely in this section of the country. The greatest development has occurred in northern Ohio, especially at Ashtabula, Toledo and Cleveland. However, nearly every city of much size, in the northern part of the United States, has in or near it one or more vegetable forcing-houses. The amount of money invested in these houses is enormous. A single acre under glass represents an expenditure of $15,000 to $25,000, depending on the kind of material used and the cost of the material at the time the building was done.

Success in the growing of vegetables under glass does not depend upon climate. Vegetables can be grown in greenhouses in any state of the Union and in any country on the earth in which vegetation flourishes. However, vegetables can be grown under glass more cheaply in moderately warm climates than in cold regions, and more easily where much sunshine occurs than where cloudy weather is prevalent.

As the gardener makes his own soil for the forcing-house, to a considerable extent, the character of the native soil is not so important as is the case with most field-grown crops. However, a sandy soil can be prepared for the forcing-house more easily than can a heavy clay soil. A good vegetable-forcing soil should con-



1545. Lean-to lettuce house, 26 feet wide. Hot water.

tain an abundance of plant-food, should have a good water-holding capacity, be capable of easy working and be as free as possible from weed seeds and disease germs.

A very important factor in determining the financial return from vegetable-forcing is nearness to market. Other things being equal, the closer the grower can get to the consumer the greater the profit. Cheapness of fuel for heating purposes is also very important. If coal is to be used, the hauling should be considered when estimating the cost.

No one thing has more to do with the success or failure in vegetable-forcing than the man who runs the business. To be a success he must enjoy the work. He should have an understanding of the requirements of the crops to be grown and ability to apply himself diligently to his work. Careful attention to details is of greater importance in connection with vegetable-forcing than with any other line of vegetable-growing. Besides being a good grower, he should be a good salesman.

The forcing of lettuce. Fig. 1548.

Head lettuce.—As this crop has special treatment elsewhere, it will need but brief mention here. The Boston growers grew head lettuce from the beginning. They were successful in the growing of it and the markets in which they sold demanded head lettuce. The soil used by the Boston growers is of a very loose texture, being well filled with organic matter. In working over the soil in the houses it is spaded to a depth of 1½ to 2 feet. Large quantities of manure are added at frequent intervals. Some growers practise steam sterilization. Heavy watering is done before the plants are set in the beds. The water-holding capacity of the soil is so great that usually no further watering is necessary until the following crop is to be put in. The lettuce is allowed to develop until the heads become large and solid, when they are cut, trimmed, washed and carefully packed in boxes, three dozen heads in a box. If the lettuce is to be shipped some distance it is put up in cases holding one barrel. It is sold by the dozen heads.

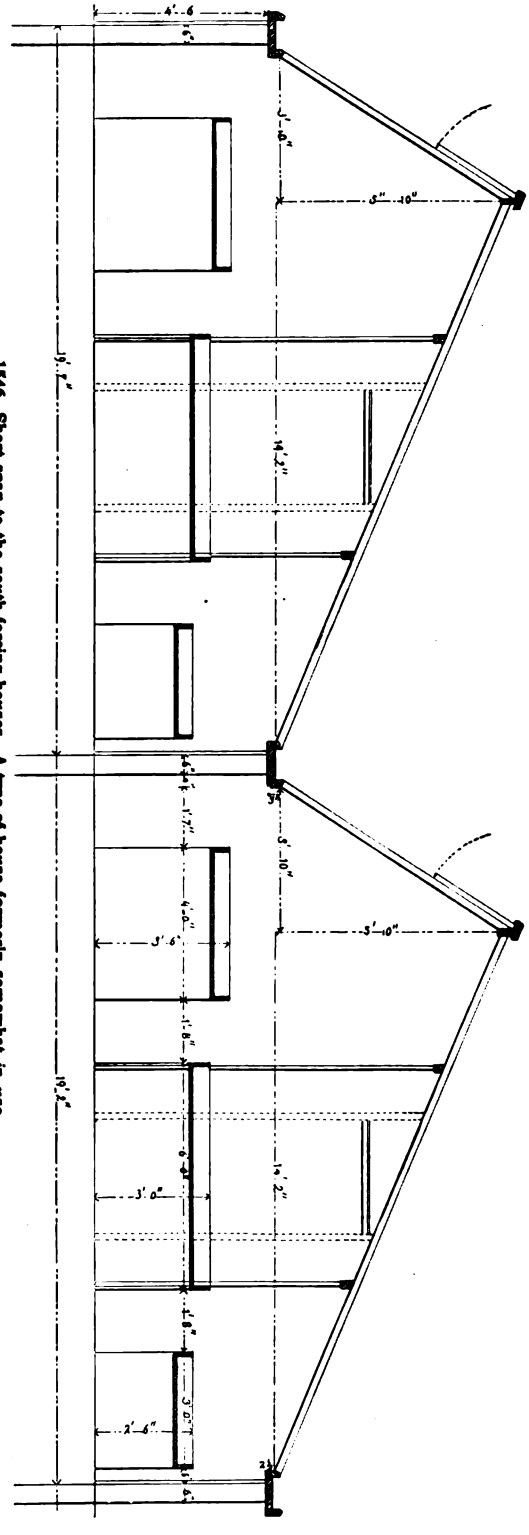
Leaf lettuce.—It was not until Eugene Davis, of Grand Rapids, Michigan, originated and introduced the Grand Rapids leaf lettuce that lettuce-forcing became popular in the middle West. The growing of head lettuce under glass did not prove a success in this region. The cry of "over-production" was heard soon after the forcing of leaf lettuce began and has continued until the present time. With the exception of short periods during the fall months of some years, there has been no over-production of this crop.

Cultural methods.

When leaf lettuce is sold by the pound, the usual practice is to grow three crops of lettuce followed by one of cucumbers or tomatoes. When the lettuce is sold by the dozen, more than three crops are commonly grown before the ground is given over to the other crop. Lettuce sold by the pound is usually grown to a much larger size than when it is sold by the dozen.

The seed for the first crop of lettuce is sown from the first to the middle of August. It is sown in flats or in solid beds, usually broadcast but sometimes in rows. It is sown very thickly and if covered at all with earth the covering is very shallow, not enough soil being used to hide the seeds entirely from view. In warm weather one thickness of heavy brown paper or burlap is thoroughly moistened and placed over the seed as soon as it has been sown and watered. The covering is left on until the seed germinates which will vary from two to five days according to the amount of sunshine and degree of heat in the house. It should not be left on too long as spindling, nearly worthless plants will result. In cold, cloudy weather seeds sown in flats will germinate best if covered with glass for a few days after sowing.

In about a week, in bright weather, and from ten days to two weeks in cloudy weather, the seedlings will



1546. Short-span-to-the-south forcing-houses. A type of house formerly somewhat in use.

be ready to prick off. This operation is tedious and requires deft hands and practice to do it well and rapidly. The plants are separated one from another, care being taken not to injure them, and transplanted into other flats or beds. They are spaced about 2 inches apart each way. All diseased and poorly rooted plants are discarded. The number of plants that can be pricked off in a day of ten hours will vary from 5,000 to 10,000 according to the skill of the operator. Some of the best growers sterilize the soil in which the seeds are sown and the seedlings grown. This not only insures plants free from disease but eradicates all weeds by destroying the vitality of the weed seed.

All the care that is required for the seedlings is to keep the planthouse at the proper temperature, see that the soil is supplied with the right amount of moisture, remove all weeds which appear and stir the soil when necessary to keep it from crusting. The house in which the plants are grown should be well ventilated in order to guard against the damping-off of the seedlings. An occasional smudging with some form of tobacco is necessary to keep the green aphis under control. The cabbage butterfly frequently deposits eggs on fall-grown plants and these hatch into green worms which feed upon the lettuce in the beds. The butterflies should be killed when seen flying near the plants and should be guarded against as much as possible.

In the fall when the days are long and many of them bright, lettuce will be large enough to set in the permanent beds about four weeks after it is pricked off. When lettuce is sold by the pound it should not be set closer than 7 by 7 inches or farther apart than 8 by 8 inches for best results. When sold by the dozen it can be set as close as 5 by 5 inches, although the best distance will depend upon the size of plants which are found most profitable to grow. The first crop of lettuce will be ready to cut, when sold by the pound, in six to eight weeks from the time the plants are set in the permanent beds. It should give a yield of at least three-quarters of a pound a square foot.

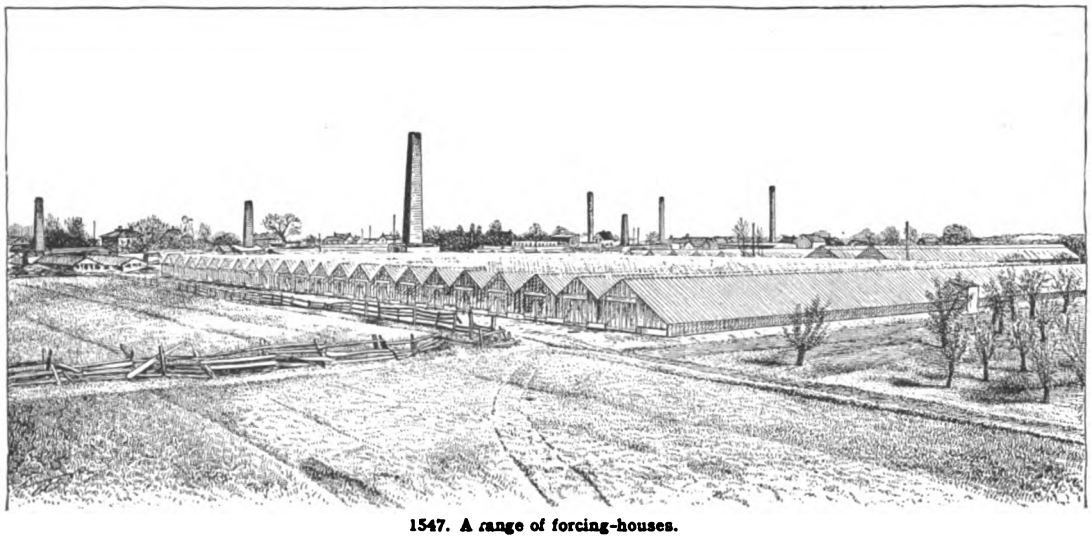
The prices that the growers have realized for the first cuttings of lettuce have, during recent years, been rather low. The cost of growing this crop is small, however, as little fuel is needed for heating purposes. The second and third crops will require more time for their proper development than the first. They should give a heavier yield, however, and the prices secured are usually better.

It is very important to have plants of the right size to set in the beds as soon as the ground can be prepared after a crop is out. To be able to do this, it is necessary to make frequent sowings of seed. In large greenhouse establishments, seeds should be sown every day or every other day, while in a small forcing-house a sowing should be made once a week throughout the season. No time should be lost between crops as time is money in the vegetable-forcing business. Considerable time can be gained by making a second transplanting for the second and third crops. The plants should be removed from the flats before they begin to crowd and placed in 2-inch pots. These pots should be plunged in the soil between the newly set plants in the permanent beds. The pots should be placed in the beds as thick again as the permanent plants are set. By following this plan, the plants can be grown to a much larger size without injury than is possible when they are grown only in the flats.

Grand Rapids lettuce will stand a wide range of temperature without serious injury, but the lower the temperature the slower the growth and tougher the leaves, and the higher the temperature the more rapid the growth and more tender the leaves. A low temperature will produce heavy lettuce and a high temperature light lettuce. As long as thorough ventilation is given, little danger of injury from high temperature will occur, but high temperature and closed ventilators invite disaster. The best results are secured when the temperature is held at 45° to 50° at night until the lettuce has attained sufficient height, 8 to 10 inches, when it should be kept as near 45° as possible. The lowering of the temperature at the finishing of the crop will increase the weight considerably. If the houses are arranged so that it is possible to keep but one temperature, a night temperature of 45° to 48° is most satisfactory. The day temperature may vary greatly without injuring the lettuce if the ventilators and heating pipes receive proper attention. Ventilation should be given at all times during the day except when the weather is very cold or stormy. The heating pipes should be turned off whenever the heat from the sun is sufficient to give the proper temperature in the houses.

Sub-irrigation is the most satisfactory method of watering lettuce. The water can be applied at any time through the tile without wetting the foliage. This method is not in general use because of the expense of installation. Water-tight benches or beds are essential for its successful operation.

The overhead or Skinner system of watering is in



1547. A range of forcing-houses.

common use, especially in large establishments. It is a great improvement over the old method of watering with the hose. It is not only more efficient but requires much less time and labor than the hose method. With it, water can be applied in any quantity desired and so gently that no baking of the soil will occur.

Whatever the method of watering, the soil should be thoroughly soaked as soon as the plants are set. It should not be allowed to dry out, as the plants will be damaged by the resulting check in growth. When the water is applied to the surface, the watering should be done only on bright days and early enough in the day so that the lettuce leaves will dry off before night.

Insects and diseases of lettuce.

The one insect that is always ready to make its appearance is the green aphis. Fumigating regularly, at least once a week with tobacco stems or extract of tobacco will keep this insect under control. In case it secures a foothold and one smudging does not do the work, a second the following night will put the aphis under control. Tobacco dust scattered on the surface of the soil before the plants are set will help to repel the aphis.

The cabbage worm is often troublesome, especially on the fall crop. Poisoning when the plants are small, and hand-picking when the crop approaches maturity, are the most practical remedies. Snails and slugs sometimes do damage, but do not as a rule appear when clean methods of culture are practised. Other insects, such as the white fly and black aphis, make their appearance on lettuce occasionally but seldom become serious.

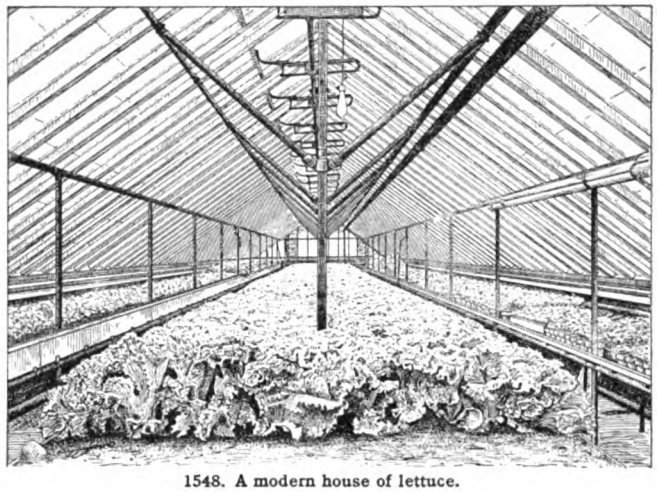
Among the more common diseases affecting lettuce is the drop or stem-rot. This rot acts very much like the damping-off of the seedlings. It is a fungous trouble and can be controlled to a large extent by thorough ventilation. Sterilization of the soil with steam sometimes becomes necessary in extreme cases. There are other less serious forms of rot affecting leaf lettuce, all of which can be kept under control, as a rule, by proper ventilation. Watering at night or during cloudy weather and high temperatures with closed ventilators are practices which will tend to induce attacks of rot.

Another lettuce trouble of common occurrence is "rosette." This is a disease which attacks the roots, retarding and in some instances stopping the growth of the plants. Sterilizing with formaldehyde, used at the rate of two pounds to fifty gallons of water and applying one gallon of the mixture to each square foot of space, has frequently given good results. Sterilizing with steam, while more expensive, is more certain to prove effective. When the lettuce is allowed to suffer from the lack of sufficient moisture in the soil, it will often have the appearance of lettuce rosette. The grower should examine the soil carefully when the lettuce appears stunted in growth to be sure that the trouble is not lack of water instead of a diseased condition before going to the expense of sterilizing.

Cutting and packing lettuce.

There is a certain time in the development of leaf lettuce when it is of just the right size and of the proper degree of maturity to cut for market. This can be determined by the feeling and appearance of the lettuce. When ready to cut, the lettuce plants will feel firm when the hand is pressed gently on the top. If the edges of the leaves show a few brownish spots, the cuttings should be done without delay. The ability to judge just when the lettuce should be cut will be acquired by practice.

Some of the large growers who make a business of shipping lettuce, pack it in barrels. It is placed with the top of the lettuce plants toward the outside of the barrel and, when filled, the barrel is covered with burlap. Fifty pounds are usually packed in an apple or cracker barrel and from seventy-five to ninety pounds in a sugar barrel. The lettuce is protected from frost



1548. A modern house of lettuce.

in cold weather by lining the barrel with paper. In warm weather, holes are cut in the sides of the barrels to admit air and thus prevent heating.

Boxes of different sizes but usually holding about a bushel are used by many growers. When the lettuce is to be shipped, the boxes are covered with wooden covers. When it is to be sold on a local market the lettuce is covered with paper or left uncovered. At Ashtabula, Ohio, all of the growers pack their lettuce in small baskets with stationary handles. Three and one-quarter pounds is packed in each basket and the lettuce and basket are covered neatly with paper.

The kind and size of the package and the amount of lettuce put in is not of so much importance as the quality of the lettuce and the care with which it is prepared for market. Bright, clean, crisp lettuce will sell much more readily than tough, dirty lettuce. All dead or yellow leaves should be removed and all dirt washed off.

Marketing.

At some of the large forcing centers the growers are organized for the purpose of marketing their crops. One man is selected to do the selling of the entire output. The growers endeavor to put up a uniform grade of produce, and inspection is provided to see that no inferior stock goes in with that which is up to the standard. This plan insures better feeling among the growers and secures better returns for them than is possible when each grower sells his own products in competition with the other growers.

A grower who has a local demand for all the lettuce he can grow has a decided advantage over the man who is obliged to ship his lettuce some distance. The person having a market within easy driving distance can, if he grows good stock and puts it up neatly, not only cut out the cost of shipping, the commission and much of the package cost that the man who must ship is obliged to pay, but he can also get a higher price for his lettuce, as he can put it on the market in better condition than is possible with shipped lettuce.

Forcing of cucumbers.

Cucumbers are forced very commonly as a spring and early summer crop in many regions. The New

England growers devote a considerable area under glass to cucumbers in the fall and winter months. Eastern-grown cucumbers are sold in western markets at the time of the year at which most of the western growers are devoting all of their glass to lettuce or tomatoes. Some of the vegetable forcers in Illinois and farther west grow cucumbers in the fall and winter.

Varieties.

The long English type of cucumber is not popular for commercial purposes in this country although it is grown to some extent in private greenhouses. The American forcing-man prefers a type of cucumbers for forcing which is of the White Spine order. The first requisite of a good forcing cucumber is prolificacy. It should be from 8 to 10 inches long, even a foot in length not being objectionable, of regular and uniform diameter, not too thick, and free from what some term "neck" ends. It should be dark green in color. The fewer the seeds and the more poorly they are developed the better it will please the consumer.

Cultural methods.

Cucumber seed is planted in pots or flats about four weeks before the plants are to be set in the permanent beds. When planted in pots two to four seeds are placed in each pot. When planted in flats the seeds are sown rather thickly in rows about 2 inches apart. The flat-grown plants are pricked off, when large enough to handle, into pots, one plant in a pot, or into flats about 4 inches apart each way. The plants which are started in pots are not pricked off but they are thinned, when necessary, to not more than two in a pot.

Cucumbers should be kept growing all of the time to get best results. In order to do this, they must be kept in a warm house. The night temperature should be above 60° and may run as high as 70°. The day temperature should run at least 10° higher than the night temperature and on bright days it can go still higher if the ventilators are open. The seedlings should never be allowed to dry out nor should they be watered too heavily as damping off is liable to occur when the soil is too wet. The watering should always be done on bright days. Cold draughts should be avoided as they induce attacks of mildew. Judicious ventilating will insure hardy plants.

The distance apart the cucumbers should be planted depends on the method of training to be used. There are two distinct methods of training, the "A"-shaped trellis and the upright. When the trellis is to be used, the plants are set in rows from 10 to 16 feet apart and from 10 to 15 inches apart in the rows. When the vines are to be trained upright, the plants are set from 2 to 3 feet apart each way, one plant in a place.

The trellises are made of wire or slats and wire which are run across 2 by 4 pieces of timber placed at wide intervals. When the vines are trained upright, strings are fastened to wires which are run above each row, one string to each vine. When training, the vines are simply twisted around the strings and the "feelers" attach themselves and thus hold the vines in place.

Some growers use slender sticks, made especially for the purpose, on which to train the vines. The sticks are 1½ by ¾ inches and from 6 to 8 feet long. A piece about 4 inches in length is nailed across the bottom to keep the stick from sinking into the soil. The tops of the sticks are fastened to wires run parallel to the rows, one wire above each row. The vines are held in place by pairs of nails driven into the sticks at intervals of 12 to 15 inches. One of the nails of each pair is bent at right angles after being driven into the stick and the bent part is dropped onto the other nail after the vine has been placed between the nails.

The pruning of the vines is similar, no matter which method of training is used. All laterals are cut back more or less. One to three female flowers are left on each lateral. Best results are usually secured when the laterals are cut beyond the first female bloom.

Cucumbers in fruiting use an enormous amount of water if it is available. As soon as the supply of water in the soil becomes reduced below the amount required for the maximum growth of the plants and fruit, the number of short runty cucumbers will increase in proportion to the number of long ones. The Skinner system or any other similar system of overhead watering is ideal for cucumbers. Care should be taken to do the watering at a time when the foliage will dry off quickly, especially if mildew or any other fungous trouble makes its appearance. Aside from the fact that the soil must be rich in plant-food, there is no other matter of as great importance as the water-supply. Whether the water be applied a little at a time and frequently or in larger quantities and at longer intervals is not of so much impo tance as the supply itself, which should be sufficient for the needs of the plants at all times.

Pollination.

Some form of artificial pollination is necessary for best results with the White Spine type of cucumber. Hand pollinating is very tedious and is seldom employed in large houses. The usual method is to place a hive of honey bees in the house and let them do the work. In large establishments several hives are required. One strong hive for each half-acre of cucumbers will be ample. When first put in, the bees are quite uneasy but they soon quiet down and make themselves very much at home.

Insects and diseases of cucumbers.

One of the most formidable insects attacking forcing-house cucumbers is the red spider. Some growers are obliged to fight this insect every season. The best way to combat it is to prevent its making an appearance. This can often be done by keeping all of the soil, walks and other places where there is enough dirt to permit of their breeding, moist at all times. When these little animals appear on the plants they can be driven off by spraying the plants thoroughly with water. To be effective, the water must be applied with force and directed against the under side of the leaves.

Another insect which causes much damage to cucumbers is the striped cucumber beetle. The stink-bug may be included with it, as the work of the two insects is very similar in its effect upon the plants. The most serious trouble with these insects does not occur when the plants are small, as they can be protected then, but when they are large. The vines which are damaged by these enemies resemble those injured or killed by the bacterial wilt. If the vines are killed by the wilt, all of the plant dies at one time. When the damage is caused by the bugs, the upper part of the plant or a lateral branch will wilt and dies first, usually but not always followed in a few days by the wilting of another branch or the remaining part of the plant. No effective means has as yet been found for combating these insects. Some growers claim that by keeping the side ventilators and doors closed most of the time the bugs will not get into the houses. To keep them out in some places the ventilator openings would have to be screened. No crops which the bugs work on should be grown near the forcing-houses. When the insects once gain admittance to the houses, they are very difficult to eradicate. The stink-bugs lay their eggs in clusters on the leaves and these should be gathered and destroyed.

The white fly is occasionally serious on cucumbers. The remedy is to fumigate with hydrocyanic acid gas, but as this gas is dangerous to both plant and animal life it is used only in extreme cases.

The green and black aphis occasionally attack cucumbers in the forcing-house. The green aphis can

be controlled by fumigating with tobacco. The black aphis usually occurs in patches and can be destroyed by applying strong solutions of tobacco or soap.

Nematodes (eel-worms) often become very destructive to cucumbers. As they work entirely on the roots, their presence is indicated by a weak and stunted growth of the vines. There is no cure for a vine once attacked. Sterilizing the infested soil with steam is the usual method of eradicating them. It is not safe to set plants in an infested soil which has not been sterilized.

Cucumber wilt is a bacterial trouble which often destroys a crop in a few days. There are no satisfactory means of combating it when it becomes established. It is most likely to occur on plants which are weakened in some other way, as by having too much water applied or too little heat. Plants which are kept growing vigorously are seldom attacked by the wilt.

The downy mildew is very partial to cucumbers and often does serious damage. Cold draughts should be avoided as much as possible. Frequent spraying with bordeaux will keep the trouble in check. Another less common but sometimes serious cucumber disease is anthracnose. Bordeaux is the remedy for this disease. Root rot of cucumbers is of occasional occurrence and may be prevented by sterilizing the soil with steam.

Grading and packing cucumbers.

In sorting cucumbers for market they are made into at least two grades. The culls are seldom placed on the market. About the same kinds of packages are used in which to pack cucumbers as are used for lettuce. They vary in size from the sugar barrel to the small basket holding from two to two and one-half dozen specimens. When handled in winter they are usually packed in paper-lined boxes or baskets.

Forcing of tomatoes. Fig. 1549.

Tomatoes are forced under glass at all seasons of the year except during the time they are ripening most freely in the field. The largest area of glass is devoted to this crop in the spring and early summer. There is also quite a large area grown during the fall and early winter. Only a very few growers force tomatoes in the midwinter months.

Varieties.

There is a difference of opinion among growers as to which varieties are best for forcing. In a general way it may be said that for the fall crop the varieties having medium to small fruits are most desirable. Some growers also prefer these kinds for the spring and early summer crop. Other growers like the large fruiting sorts, such as the Stone and Globe for the summer crop. Some markets prefer pink or purple varieties and others red sorts.

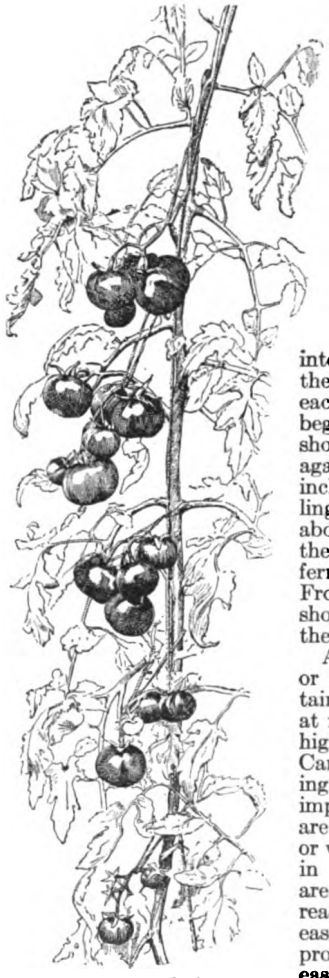
Some of the requirements of a good forcing variety are: prolificacy, smoothness in form, meatiness and good flavor. If the fruit is to be shipped it should not be too tender of skin. Some varieties crack more readily than others and those that are inclined to crack should be avoided. Other qualities not lacking, those kinds which are most resistant to disease are to be preferred. Some varieties need less attention in the matter of hand pollinating than others. This is a desirable character and should be given consideration when selecting a variety for forcing purposes.

Cultural methods.

For the fall crop the seeds should be sown in June. The best results are secured from this crop when the fruit is all set and well grown before cold weather begins. The crop should begin ripening about the time killing frosts occur and the bulk of the crop should be off by the first of January.

For the spring and early summer crop the seed should be sown in time so that the plants will be ready to set in the permanent beds by the first of March. If a temperature of 60° can be maintained at night, the plants can be grown in two months from the time of the sowing of the seed. Plants set in the permanent places the first of March should ripen fruit about the first of June and should be through fruiting by the middle of August or a little before.

The care of the seedling plants is about the same for the fall and spring crops, except that owing to the difference in the amount of sunshine they can be grown more quickly and easily in summer than in winter. For either crop the seeds are sown thickly in flats or beds and in rows about 2 inches apart. As soon as they are sown the seeds should be covered with glass, paper or burlap to keep the surface of the soil moist. When large enough to handle, the seedlings should be pricked off into flats or beds, spacing the plants 2 inches apart each way. Before they begin to crowd, they should be transplanted again, this time into 2-inch pots. A third handling should be made in about three weeks when the plants should be transferred to 4- or 5-inch pots. From these pots they should be transplanted to the permanent beds.



1549. Strand of winter tomatoes.

A temperature of 60° or 65° should be maintained in the plant house at night and at least 10° higher on bright days. Careful attention to watering and ventilating is very important. Plants which are given too much water or which grow in a house in which the ventilators are seldom open will be readily attacked by diseases. Plants which are properly grown are disease-resistant to a considerable extent.

The spacing of tomato plants which is practised by different forcers is much more nearly alike than is the case with cucumbers. The plants are seldom set closer than 1½ feet nor farther apart than 4 feet. Two by 2 feet or 1½ by 3 feet are good distances. Nearly all tomatoes are trained upright and usually to one stem. When two stems are used, the tops are trained apart a foot or more, making the plant form the shape of a partly opened fan. Strings run from the foot of the vines to wires run above the rows are the usual means of support. By twisting the vines around the supporting strings, only a small amount of tying will be necessary. All laterals or side branches should be removed when small if the plants are trained to one stem. If they are to be trained to two stems, the lowest

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strong lateral should form the second stem. The lateral just above the first blossom cluster is usually the strongest. All other side branches should be removed. The pruning requires careful attention and consumes much time. If the laterals are allowed to grow to a large size before they are removed, it will, not only require more time to cut them off but they will take needed strength from the main branch.

Pollination.

As honey bees do not work on tomato blossoms it is necessary to do more or less hand pollinating, the amount depending on the time of the year, the number of blossoms open and the varieties grown. If the weather is such that the ventilators can be kept open wide most of the time during the day, frequent and systematic jarring of the plants will be fairly satisfactory. Artificial pollination is more necessary when the plants first begin to bloom than when the amount of bloom is abundant. Some of the English types of forcing tomatoes do not require much attention in the matter of pollinating. However, it is better to be on the safe side and do more pollinating than necessary rather than not enough. The camel's-hair brush is used by some growers and the wooden spoon and spatula with handles 15 to 18 inches in length are used by other growers as a means of transferring the pollen from one flower to another.

Grading and packing tomatoes.

Unless they are to be shipped a long distance, forcing-house grown tomatoes should not be picked until they show considerable color. The more nearly mature the fruits are when taken from the vines, the better the quality. Picking should be done every other day or at least three times a week. The fruit should be handled with care to avoid bruising, as injuries impair the keeping quality of the fruit.

In grading, unless the fruit is unusually rough or too variable in size, only one grade need be made for the average market. All very rough and otherwise inferior fruits should be withheld from the market. Some growers make a fancy grade for special trade. This stock should be of medium and uniform size, even in color and very smooth. The hotels and clubs which give orders for such stock are willing to pay an extra price for it.

Tomatoes are handled mostly in baskets. These are seldom larger than a half bushel and usually considerably smaller. The basket used by the Ashtabula growers is the same as they use for lettuce and holds ten pounds of tomatoes. A very satisfactory package for use in warm weather is the four-basket carrier or crate. The baskets which are put in this carrier hold five pounds each. When properly selected as to size, color, and smoothness, tomatoes packed in this container are very attractive. The chief objection to their use is that they are too much like the package used by the southern tomato-growers and thus not distinctive enough for the forcing-house tomatoes. During cold weather or when the tomatoes are to be shipped a long distance, each fruit should be wrapped in paper to protect it from the frost and to prevent bruising.

Dealers who have not handled forcing-house-grown tomatoes are sometimes slow to pay the price which the stock, if well grown, graded and packed, should demand. When they have once learned that forcing-house-grown tomatoes are of superior quality and will stand up much better than those which have been shipped a long distance and of necessity must be picked green or nearly so, they are usually willing to pay much more for the forcing-house-grown than for the outside-grown tomatoes.

Forcing of radishes.

Radishes have been forced by many growers but they have not become generally popular. This is no doubt due largely to the fact that the growing of them and preparation for market necessitates a large amount of hand labor; and the requirements of the crop are exacting.

The turnip-shaped sorts are most satisfactory for forcing in the forcing-house. The seed should be sown thickly in rows which should be marked 4 inches apart and about ½ inch deep. The Skinner system of watering is very satisfactory for radishes if the watering is properly done. The soil should be kept moist but not too wet on the surface. The watering should be done only when the weather is bright. Some growers have found it more satisfactory to allow the radishes to remain quite thick in the rows until a part of them are large enough to market and then pull the marketable ones and allow the others to develop, than to thin them enough when they are small to permit the radishes to mature nearly at one time. This method of thinning will enable the gardener to grow many more radishes in a given area than when the old method is used.

Some of the essential factors in successful radish forcing are: good seed, carefully sown; an abundance of light; plenty of ventilation; sufficient water and heat to keep the plants growing rapidly but not enough to cause damping-off; neatness and cleanliness in bunching, washing and packing.

Other forcing crops.

Space will permit only of a classification of other forcing crops than those previously mentioned. Nearly all kinds of vegetables which are grown in the open can be grown in the forcing-house. Whether it is practicable or not to force a vegetable in a commercial way depends principally on two things: cost of production and market demand.

The following lists include practically all vegetables which are forced commercially, either extensively or to a limited extent. The vegetables included in these lists are divided into two classes, the "cool" and the "warm" plants.

By cool plants is meant those for which the proper night temperature is from 40° to 55° and by warm plants those for which the night temperature should be from 55° to 70°. With either class of plants the day temperature on bright days should be at least 10° higher than the night temperature.

"Cool" forcing vegetables:

Asparagus	Cress	Pea
Beet	Lettuce	Radishes
Carrot	Onion	Rhubarb
Cauliflower	Parsley	Spinach
Celery		

"Warm" forcing vegetables:

Bean	Eggplant	Pepper
Cucumber	Muskmelon	Tomato

C. W. WAID.

The forcing of fruits.

The forcing of fruits under glass has increased considerably in recent years and particularly so in the private establishments. Grapes probably occupy more space than any other class of hothouse fruits. Records of cultivating the vine may be traced back some thousands of years. Nevertheless, the greenhouse grape-vine has not been improved to the same extent through systematic hybridizing that many other fruits have been. Some of our oldest varieties still hold a prominent place in the forcing-houses. Some worthy claimants have been added to the list from time to time. Madresfield Court was raised over forty years ago by crossing Muscat of Alexandria with Black Morocco, producing a distinct Muscat grape with the Morocco coloring. Of later introduction may be mentioned Lady Hutt,

Appley Towers and a few others which have been tested and have found favor with many growers. Another account of raising grapes under glass will be found in the article *Grape*.

Forcing of grapes.

The vine is of easy propagation. Different methods may be applied for reproducing young vines, such as cuttings or by eyes of ripened wood. Inarching and grafting may also be resorted to. However, the general method of raising young vines is from single eyes. It is advisable to choose wood of the previous season's growth or, when pruning back the vines, to take thoroughly ripened wood with plump eyes. If not ready for propagating, the wood may be heeled in a cool house until needed. The month of January is best for this purpose, for then there is usually a steady bottom heat, which is necessary. A bottom heat of 70°, with a temperature in the house of 65°, is most satisfactory. Furthermore, January-propagated plants allow for a long season to grow on the canes. In preparing the eyes for propagation, about ½ inch of wood on each side of the eye is sufficient. Make a cut on the opposite side from the eye a trifle deeper than the bark, which will callous in a short time after it is placed in heat and roots will emit in two or three weeks. These eyes may be placed in pans, flats or singly in 3-inch pots; when time is no serious object, the pots are decidedly to be preferred, as the young vine roots are very brittle. In preparing the pots to receive the eyes, half fill them with fibrous soil and fill the top with a fairly sharp sand, enough to cover the wood with the eye just level with the sand. The advantage of having the soil in the bottom is that the roots will strike down and the plants may be repotted, when ready, without a check. They must be kept growing through the summer in a warm moist house and repotted when necessary.

1550. Pot-grown apple tree in bearing.

Inarching may be found valuable at times, particularly if there is a variety in the house that is not desirable. The operation is fairly simple. There are different methods of inarching, although the most successful is with the young growing wood. For example, to inarch a variety with a permanent vine, preparations should be made the year previous. Grow the variety desired in a pot, then ripen off as for planting. Whenever the vines are started into growth, bring in the pot vine intended for inarching, about ten days after the heat has been placed in the grapery. Otherwise the pot vine will start into growth before the permanent vine. It is advisable to select shoots of about the same strength, if possible. The shoot that is operated on should be as near the base as possible. To inarch them is just a matter of bringing the two shoots together and tying with raffia. When the cion has united with the green growing shoots, which will be in a short time, gradually cut it away from its own root; also pinch the stock back by degrees to increase the strength of the cion. Usually the cion will grow away rapidly and produce a strong cane by fall so that when pruning time comes the following winter the old cane may be cut away and the new variety will take its place.

Hybridizing.

In hybridizing with the aim to produce new varieties, it is best to select a fairly strong-growing variety for the female parent, choosing the rich Muscat pollen for the male parent. No estimate can be formed as to results from a true cross, as many different varieties will appear. Grapes will produce an abundance of pollen and great care must be taken to avoid self-fertilization. Nature protects the pollen of the grape-vine by a cap that surrounds the pistils and stamens, and when the pollen is ripe for distribution the caps are pushed off by the expansion of pistils and stamens, insuring pollination. To cross-pollinate one variety with another, measures should be taken in advance of natural development to prevent self-pollination. Select the bunch to be operated upon a few days before it would begin to flower. Cut away the larger part of the flowers, leaving a dozen or fifteen to be crossed with other pollen. Then secure this bunch in a fine muslin bag, which will prevent any insects from distributing undesirable pollen upon it. The muslin will allow sufficient air for the berries to set, after which it may be removed. The bag is placed around the bunch a day or so before the cap is ready to be dislodged, and careful watch must be kept when the cap begins to loosen. Have a pair of very fine plyers or pincers ready and remove the cap by force, then immediately cut away the stamens before the pollen has time to ripen. This must be executed with great care as the flowers are very delicate. Sometimes the flowers cannot all be operated upon at the same time. If so, place the bunch again in the bag and repeat the above process. When the stamens have been removed, apply the pollen chosen for the cross. This is best applied to the stigma with a camel's-hair pencil. Repeat until the whole have been gone over carefully. By using these precautions, the bunch cannot become contaminated with undesirable pollen. Grape seed will germinate very readily, although it should be sown soon after ripening as its germinating power is weakened if kept any great length of time.

Vine borders.

Good drainage is absolutely necessary for the successful cultivation of grape-vines. They will not resent an abundance of water while in active growth, in fact they demand it, but a border which the water cannot pass through freely will be found a serious difficulty. It is well in finding a location to choose, if possible, a site on elevated ground, as the drainage from the border can be carried off with less expense than in a low place, without the trouble of the drain-pipes becoming stopped up. A vine border will last for years and the advantage of a well-made border, even though expensive in building up, will be manifest in the better fruit produced.

A grapery may be supplied with both outside and inside borders, although it is not necessary. Neither would it be advisable for early forcing, for the reason that many of the roots would be out in the cold soil at quite a contrast from the ones inside. But for mid-season or late, there is no objection to this method. In fact, vines that have access to an outside border will keep healthy and vigorous several years longer than when confined wholly inside. However, an inside border will last for at least ten or fifteen years. This must be decided before the house is built as, for an outside border, the walls must be erected on arches to allow the roots access outside. One advantage of this method is that the vines do not require such close attention as when depending entirely upon the inside border. However, at present the larger number of graperies are built with inside borders only. The first thing to be done is to excavate at least 3½ to 4 feet for

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the border. Assuming it to be a span-roof house, lay a drain down the center, allowing enough fall to carry off the water. Use 3-inch pipes and provide openings along every 20 feet or so to take away the water. After the drain is complete, a coat of rough concrete may be placed over the bottom, which will prevent any of the vine roots from penetrating into the subsoil. Over this add a foot or 18 inches of drainage, such as broken stone or brickbats,—anything that will insure a free passage for water. From the drainage to the surface level, there should be about 2½ feet or a trifle over for soil. In some localities it is difficult to secure a grade of soil best adapted for vine-growth, although grape-vines will thrive in different kinds of soil, if not too sandy or too clayey. A good loamy soil is best, virgin loam preferred; or loam that has been in pasture three or four years may be plowed and placed directly into the border. The grass fibers are of great benefit. The vines would make a very satisfactory growth for a year or so without any fertilizing ingredients added. However, this would not be a wise policy and fertilizers of a lasting quality should be used. On that account, farmyard manure should not be used. All fruits require potash, phosphoric acid and nitrogen and therefore these manures should be applied. Do not apply the fertilizers too heavily. It is a simple matter when the vines become thoroughly established to feed from the surface. Bone is one of the very best ingredients to place in the grape border. This may be used in a coarse state or that known as ½-inch bone at the rate of forty or fifty parts of solid to one of bone. Potash may be used in the shape of hardwood unleached ashes, a trifle less in quantity than that recommended for the bone. Toward the surface, a quicker-acting complete fruit-fertilizer may be used. Such a border should grow and produce grapes for many years.

1551. Pot-grown pear tree in bloom.

A span-roof house running north and south is recommended, as a certain amount of sunlight will be had on both sides, whereas in a house running east and west, very little sun will strike on the north side. Either curvilinear or straight span answers the purpose for a private establishment.

Planting vines.

Vines may be planted either in fall or early spring. Early fall-planted stock appears to come away more freely and break stronger than spring planting. Plant the canes about 4 feet apart; there is nothing gained by too close planting. It is immaterial whether one-year-old plants are selected or two-year-old, providing they are thrifty strong canes. They should be shortened back to 2 feet to insure strong growths from the remaining buds, since, if a much longer length of cane is left, they will break away unevenly and weakly. Before planting, all the soil from a ball should be removed and the roots straightened out. Spread the roots out evenly on the border, cover with about 3 inches of soil and firm the soil well around them.

General treatment for forcing.

Grape-vines respond to the forcing treatment readily, although a newly planted grape-house should be brought along with little or no forcing the first season. There would be no advantage in forcing them, as they should not be allowed to produce fruit until the second year, when they will be thoroughly established. However, assuming that the vines are established and grapes are needed from the first to the tenth of May, the house must be started by the middle of December with a temperature of 45° to 50° at night, with a rise of 10° to 15° by day, according to weather conditions, and gradually increasing so that when the grapes are in bloom the temperature will be 65° at night and 75° to 80° by day. If a supply of grapes is demanded up to Christmas or the New Year, three compartments must be accommodated, the midseason house being started two months later and the late house about the first of April. A very important point to be considered is to give the border a thorough watering, for while the vines are at rest they are kept fairly dry. Ventilation or airing is very important, for unless this is attended to carefully serious trouble will follow, such as mildew, red-spider and the like. The heat should be allowed to rise gradually until the maximum is reached in the morning, then kept as steady as possible and toward evening gradually lowered to night temperature.

The best method of growing vines under glass is the single-rod spur system. The spurs should be 15 or 18 inches apart on each side of the rod. Then disbud to one shoot for each spur. As the young growth advances, it must be trained in place by degrees, as the young shoots are very brittle and if brought down too quickly are liable to snap off. The next step is pinching the shoots. The aim is to allow enough growth to cover the trellis with foliage but to avoid crowding. A fairly safe method is to stop the shoot at the second or third leaf beyond the bunch, also pinch all lateral growths at the first leaf.

Probably one of the most anxious times with the man in charge is while the vines are in bloom or setting their fruit. Certain varieties will set their fruit much more freely than others. The Muscat family, as a rule, is a bit backward in that respect. A safe method to follow is a steady temperature with a fairly dry bracing atmosphere so that the pollen can distribute itself freely. By gently tapping the bunches around midday, they should set freely. When the berries are about the size of garden peas, they are in condition for thinning. This is a tedious operation, requiring time and patience. The bunch must never be handled with the fingers. Either a stick with a fork or a straight stick to lift the shoulders of the bunch while thinning should be used. The aim is to cut away enough surplus berries to allow the remainder to swell to full size, so that when full grown and ready to cut the bunch will keep the same perfect shape when set on the dinner-table.

Grape-vines, when in a healthy, vigorous condition, are rank feeders. There is no better time to apply food than just after the grapes are thinned and again as they take on their second swelling after the stoning period. This may be applied in the shape of liquid manure water or a complete chemical fertilizer. The grower must use his own judgment in regard to quantity, as so much depends on conditions. A healthy vine can withstand more food than one less robust. Nevertheless, it is much better to feed lightly than too heavily.

A moist humid atmosphere is necessary for grapes while they are growing or from the time they are started into growth until they begin to color, from which time a drier bracing air will be of advantage. At this stage, bottom air may be admitted by degrees during the day, and later, or when ripe, keep bottom air on day and night.

Pruning.

There are two objects in pruning: first, to keep the vines in submission and second, to encourage vigor. For the first season after planting, it would be well to allow the vines to grow freely with very little stopping of shoots. This encourages root-action and if everything has progressed satisfactorily, the canes will

XLIV. Forcing of grapes.—Muscat of Alexandria.

reach the top of the house the first season. When pruning time comes, this cane must be shortened back, allowing only about 5 feet of the season's growth to remain. The same method should be adopted the following year and so on till the full height of vine is secured. Before beginning to prune a grape-vine, one should be absolutely sure the wood is thoroughly ripe. This may easily be ascertained from well-ripened wood, for after pruning the cut will remain perfectly dry and in a few days have the appearance of an old cut. On the other hand, if the wood cuts soft with a fluid on the cut, then the wood is not ripe enough. To produce well-ripened wood from the time the crop is gathered till pruning time, an abundance of air should be allowed in the house and when the foliage has completed its functions a dry atmosphere should be maintained and the vines kept fairly dry at the roots. In the long-rod spur system, it is necessary to prune hard back, otherwise in a few years long ungainly spurs will result. One or two eyes to each spur is sufficient and, with thoroughly ripened wood, there is no danger but that a bountiful crop will follow.

Varieties.

There are many varieties for forcing purposes, although only a selection of the best varieties, early and late, is given here. The Muscat grapes are the finest of all the hothouse kinds. Unfortunately they require a longer season to ripen. Consequently one must rely on earlier-maturing varieties for early forcing. A few canes of Muscats may be planted in an early house and they will be useful after the early kinds are exhausted. It is not wise to depend on thin-skinned Muscats for late use, as there would be difficulty in keeping them in condition any length of time. The following varieties are recommended for early, midseason and late:

Early.—Black Hamburg, Appley Towers, Madresfield Court, White Buckland Sweetwater, Foster Seedling, Royton Muscat.

Midseason house should be devoted wholly to Muscat of Alexandria, which is one of the finest of all indoor grapes. It thrives better in a compartment by itself, requiring a trifle more heat.

Late house.—Gros Colmar, Gros Maroc, Barbarossa or Gros Guillaume, Alicante, Diamond Jubilee, Prince of Wales, White Lady Hutt.

Many others may be added to the list, but these will be found to cover the season and varieties sufficiently for all purposes.

Forcing of peaches and nectarines.

These fruits come next in popularity to the grape and considerable space is devoted to their culture under glass. Great improvements have been brought about in recent years with both peaches and nectarines and a large number of new varieties are constantly appearing for forcing. One of the handsomest forcing peaches is Peregrine. The color is magnificent and flavor all that could be desired, with size sufficient to please the most exacting. Others might be mentioned to show the progress of time.

Cultural methods.

The same style of house that has been recommended for grape-culture will be found ideal for peaches and nectarines, although instead of having the walk down the center of the house, it is better along each side. This will allow planting the trees crosswise of the house on trellises about 6 feet apart, which affords ample space for a well-balanced tree. Also the same arrangements in regard to borders, drainage and so on should be carried out, although a slightly shallower border would be satisfactory. From 2 to 2½ feet of soil would be sufficient; nor is it necessary to make the border quite so rich for peaches and nectarines as for grapes, as the trees would have a tendency to rank growth, a condition that should be guarded against. Peach trees budded on plum stock are superior for forcing purposes. Choose the best trees obtainable for this work. In our climate, if everything goes well, the trees will grow into large proportions in three or four years. Therefore, space should be considered with this in view. A tree that is planted in such a way that the branches are evenly balanced on both sides, causing an equalization of the sap, will insure better results. Assuming the peach-house to be 25 feet in width with the trellis crosswise the house, allowing a walk on each side, each tree would have a spread of about 18 feet. One tree in the center of each trellis is sufficient, which allows ample room for development. If desired, a tree may be planted on each side of the permanent one for two or three years, but must be cut away as the space is needed for the permanent tree. Still another method may be adopted and probably the best, which is placing trees in tubs on each side, then as space is needed they may be moved away, whereas when planted in the border one is likely to leave them too long and crowd the main tree out of shape.

It would not be wise to force newly planted trees to any extent, but rather to bring them along gradually for the first season, when they will be in condition for forcing. If ripe fruit is in demand about the first week in May, the house must be started about the middle of December. The peach tree will come on and develop its blossoms in a comparatively moderate temperature and it would not be wise to submit it to extreme heat artificially. Peach trees delight in fresh air, and will resent a too close humid atmosphere. A temperature of 40° to 45° at night and 50° to 55° by day will suit their requirements at the start. Gradually increase this so that the temperature will range from 50° to 55° at night and 60° to 65° by day or 70° with sun heat when in bloom. After the fruit is set, another 5° may be added. Give plenty of air without lowering the temperature, particularly in cold weather. Give the house a light spraying two or three times a day when the weather is clear until they come into bloom. Do not spray while they are in blossom. After the fruit is set, spraying may be resorted to again once or twice a day according to weather conditions.

Peaches are subject to greenfly. As a precaution after the fruit is thoroughly set, syringe every ten days or so with a solution of whale-oil soap, enough just to color the water. This is an excellent remedy for both greenfly and red spider, both deadly enemies to peach foliage.

The peach tree will produce many more shoots than are needed to furnish the trellis, therefore the surplus will have to be removed. This is best done by degrees rather than removing them all at once, which would be likely to cause a check. A number of shoots may be pinched at the third leaf, which in all probability would form spurs or fruit-buds for the following season. The aim is to allow enough wood to remain to cover the trellis, but to avoid crowding. As the crop advances or before the fruit becomes of much size, thinning of the fruit would be in order. It is a serious mistake to overcrop. If a tree has a tendency to rank growth, a fairly heavy crop would be of advantage. The grower must be governed according to conditions.

Watering and feeding are important. Potash is necessary for all stone-fruits and should be applied in some form, or a complete fruit-fertilizer may be recommended. It is better to feed light and often rather than too much at once. Enough water must be supplied to give the border a thorough watering from top to bottom. Then no more should be given until necessary, for if the soil is not allowed to sweeten up it would be impossible to keep the trees healthy. It is not a good policy to have the trees or borders saturated just as the fruit is ripening. It is better to give them a watering a week or so in advance, which will usually last until the fruit is

gathered. The object of this is to improve the flavor of the fruit.

One should not think that after gathering the fruit the house needs little or no attention. The temperature will not need close watching, but the fruit-buds have to form and develop, and good attention to watering and spraying the foliage is a wise step toward success for the following season. Cut away any useless wood after the crop of fruit has been picked, thus allowing the remainder of the wood to become well ripened. Well-ripened wood will withstand any reasonable amount of frost during the dormant state, and fruit-buds will respond when called upon with abundance of healthy strong blossoms. Winter-pruning may be done any time after the trees have cast their foliage. This means removing any weak growths, shortening back extremely strong growth and training the young wood so that it will spread over the space about 5 inches apart.

Varieties.

For forcing there are many varieties to choose from. The peach crop may be extended at least seven weeks for one house, but if the compartments are at command a season of five months or more may be had by planting early, midseason and late varieties. The following varieties may be relied upon for early, midseason and late:

Early forcing peaches.—Duchess of Cornwall, Duke of York, Peregrine.

Early forcing nectarines.—Cardinal, Early Rivers, Advance, Lord Napier.

Midseason peaches.—Peregrine (Alexander, Noblesse), Bellegarde, Grosse Mignonne.

Midseason nectarines.—Stanwick-Elruge, Rivers, Orange-Chaucer.

Late-house peaches.—Crawford Late, Thomas Rivers, Princess of Wales.

Late-house nectarines.—Newton, Spencer, Humboldt, Victoria.

Numerous other varieties could be added to this list. However this will be found sufficient for all practical purposes.

1552. Pear in fruit under glass.—The Hardy.

Pot-fruits.

This method of producing fruit has found favor with many growers throughout the country, particularly in private establishments. It requires no specially built houses for the purpose, providing the house receives full sunlight with abundance of ventilation. There are two or three advantages of this concentrated method of growing: first, the house may be used for other growing crops after the fruit is gathered, as the trees may be placed outside or, as severe winter sets in, they may be stored away in a coolhouse close together until such time as they are needed for bringing into growth again; second, a large variety of fruits is adapted to this method of culture, such as peaches, nectarines, pears, plums, figs and the like. These trees may be grown into either pyramid or half-standard forms. Pyramids, as a whole, make a more attractive appearance in a house than any other form of training. A house for pot-fruits requires about the same treatment as that recommended for peaches planted in a permanent border. Care and watchfulness are required as to watering, particularly when first starting into growth, as at that stage there is not much foliage, consequently an over-abundance of water would have a tendency to sour the soil. Potting the trees is very important. There is no better time for this operation than early fall, or just as they are casting their foliage. Also a serious error is placing them in too large pots or tubs. They should be repotted every fall, but it is not always necessary to give them a larger tub. Often the ball may be reduced and placed into the same-sized tub. The soil should consist of a good fibrous loam used in a fairly rough state, if possible, as this will allow free action for the water to pass off. Firm potting is of great importance. Three parts of soil to one of thoroughly decayed rich manure with a little bone mixed in would be an excellent compost for the purpose. Careful watering after repotting is very important.

When the trees come into bloom, keep a fairly dry bracing atmosphere. Pears and plums will refuse to set their fruit otherwise. As the growth advances, frequent pinching or stopping the shoots should be attended to. Some growths will doubtless be much in advance of others. When the young growths reach the length of 5 or 6 inches, they should be pinched and again when they have extended another similar growth and so on. Usually in the case of pyramid trees, growth will be found more advanced at the top, hence those shoots should be stopped, resulting in more vigor for the lower branches.

Surface-dressing when the fruit is swelling is of great benefit. Either manure or a concentrated fertilizer may be mixed with the soil and added as a top-dressing, but by all means do not apply this until the fruit is swelling away freely.

Pot-fruit that has been properly cared for during the season of growth in regard to pinching and summer-pruning requires little winter-pruning aside from removing the very weakest growths.

Varieties.

The following varieties are the best:

Pears.—Souvenir du Congres, Madame Treyve, Hardy, Fondante d' Automne, Louise Bonne, Conference, Magnet, Pitmaston Duchess, Durondean, Princess.

Plums.—The Czar, Blue Rock, Oullins Golden, Early Transparent, Gage, Mallard, Denniston Superb, Belgian Purple, Golden Esperin, Transparent Gage, Green Gage, Grand Duke.

Figs.—Brown Turkey, Negro Largo, White Marseilles, Violet Sepor.

Apples and apricots also may be added, although they are not so profitable as the others mentioned.

WM. TURNER.

Forcing hardy plants.

Forcing is an economical method of securing large quantities of flowers in winter; it is extensively used by commercial florists for cut-flowers and flowering plants. Plants usually forced are hyacinths, tulips, narcissi and other Dutch bulbs, lily-of-the-valley, astilbe, dicentra, hybrid perpetual and rambler roses, *Deutzia gracilis*, hybrid rhododendrons (*R. sinense*) and Ghent azaleas, tender hydrangeas and lilacs.

This mode of procuring flowers at small cost has always been more or less in vogue among plantsmen, and of late years has received fresh impetus, owing to the heavy demands for decorative plants at Easter. It is not only an inexpensive method of getting flowers, but with most plants, after a little experience, the time of blooming can be easily calculated. The process has limitations, at any rate with our present knowledge of the matter, inasmuch as, with the exception of "retarded plants" and a few bulbs, it is not practicable in late autumn and early winter without the use of ether. It is possible, however, that by using "retarded plants," i.e., plants held over their natural time of flowering by keeping them in cold storage at a temperature sufficiently low to prevent growth, this difficulty may eventually be overcome. Except, however, with lily-of-the-valley, which is admirably adapted to this practice, little is known of the possibilities of this form of forcing; it is hoped that other plants, equally useful, may be treated in this way. It is evident that, on account of the cost of storage, bulky plants could not be handled.

1553. Azalea, received from Europe, now pruned for forcing.

1554. Rhododendron, received from Europe, ready for forcing.

The requirements for successful forcing are: (1) a good knowledge of the plants; (2) proper preparation; (3) a period of rest; and (4) proper care after the plants are brought into heat.

Those plants force most easily which bloom in spring and early summer. Late-blooming kinds, like *Rhododendron maximum*, clethra and *Hydrangea paniculata* var. *grandiflora*, do not give good results. No success is obtained with asters and goldenrod, unless they are retarded. These points must be studied out by the grower.

Trees and shrubs should be specially prepared for forcing by careful cultivation for one or two years before use. They can be planted out-of-doors, with plenty of room to develop, or they can be grown in pots, the latter method being used with vigorous plants, which are apt to run to growth without developing flower-buds. Close pruning is necessary, and root-pruning is helpful. Grafting, which has a tendency to dwarf and hasten maturity, is also used with strong growers. Sometimes both growing in pots and grafting are employed, as in lilacs.

A plant fit for forcing must be compact, both top and roots; economy in space is essential. It is now possible to secure from the French, Dutch and Belgian nurseries many plants grown for this purpose. A few come pot-grown, but most of them are from the open ground: very little of this work is done in American nurseries. Figs. 1553–1555 show the methods of preparing woody plants for forcing.

Herbaceous plants should be prepared for forcing with equal care, and the process may require several years. The removal of the flower-buds and growth, under high cultivation, in close, compact clumps, apparently produces the same results that pruning and grafting accomplish for trees and shrubs. Fig. 1556 shows the root-clump of an herb prepared for forcing.

Plants that have once been forced are commonly thrown away. It is generally cheaper to buy new stock, but lilacs, azaleas, and the like, can be planted out and will recover sufficient strength in two years for a second forcing, or for other use. Some species, like *Viburnum plicatum*, staphylea, and xanthoceras, if grown on in pots after forcing, may be again forced, and seem to do better the second year. This is probably explained by the fact that insufficient preparation was given for the first trial, the first forcing being really "proper preparation" for the second forcing.

1555. Lilac pruned for forcing.

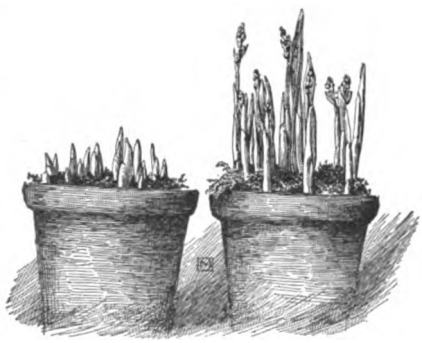
Hardy plants must have a period of rest for successful forcing, the time required varying in different species. One cannot tell, except by experiment, that Paper White narcissi will force easily in November and December, while the double Von Sion will not; the individual equation of each kind is an element which must be considered. There is a popular notion that freezing will shorten the time for resting, or, at any rate, is conducive to the welfare of the plant. This idea does not seem to stand any practical test. After potting, do not subject the plants to severe frosts (10° to 12° F.), or else the roots, now much exposed, may suffer. The large buds of lilac and rhododendron may also be injured if frozen hard.

Pot the plants as soon as they ripen their growth in autumn, beginning in September with herbaceous stock,

and continuing until severe frost. It is possible, but not desirable, to lift some things after the ground is frozen hard. Plants received from abroad are potted on arrival, or, if furnished with a ball like azaleas (Fig. 1553), they can be stored and not potted until brought into heat. Dutch bulbs are boxed or potted as they are received, and buried in the earth or piled in stacks and covered with enough leaves and litter to exclude frosts. Lily-of-the-valley, astilbe and dicentra may be kept in their packing-cases in a cool pit until ready for use. Large plants in tubs and boxes can be covered with leaves and kept out-of-doors, but most plants should be stored in a cool cellar, pit or frame kept at a temperature of 35° F.; a temporary variation of 5° either way does no harm. It is well to delay this storage until as late in the season as possible, but it must be done before severe weather. Plants may be stowed compactly in several tiers if necessary. It must be remembered that no growth is to be allowed while stored; it is their period of rest, and this must be enforced. Good ventilation must be given on bright days and every precaution taken against an accumulation of moisture: if the plants are well watered when put away very little will be required afterwards. Dampness is most serious with evergreens, like kalmia, and such things as *Phlox subulata*. This stock should have the airiest positions; sometimes it can be placed in shallow frames 2 feet deep, which are drier than deep pits. In severe weather the pits are often covered with snow a week or more, but the plants will not suffer if this happens but once or twice during the winter. At such times mice and squirrels will make trouble unless trapped or poisoned.

1556. Dicentra roots prepared for forcing.

Nothing except retarded plants, a few bulbs and one or two kinds of prunus should be brought in before November. December 15 to January 1 is as early as it is safe to begin forcing most hardy plants; it will be found that as the days lengthen the results will be more satisfactory. At first the plants must be kept cool, 45° F., or thereabout. Syringe twice a day until the buds swell: after growth starts the treatment is the same as that given greenhouse plants, and they can be put in a much warmer house if so desired. It is at this time that care in handling, particularly in the matter of heat, makes it possible to time the period of blooming so accurately, but it is impossible to give any general rules satisfactorily to cover these matters.



1557. Forcing lily-of-the-valley in pots.

A few plants, like lily-of-the-valley, can be placed directly in a forcing-box, generally made over the pipes in the hottest house, where a temperature of 80° or more can be maintained. They are first soaked in water for a day or two and then kept in this heavy heat until flower-buds are well developed (Fig. 1557).

Tulips, hyacinths and other bulbs, sometimes an azalea or lilac, can also be hurried up in such a box, but it is dangerous, and not good practice; better and more lasting flowers come with ordinary treatment. Trilliums (Fig. 1558) and various early-flowering wild plants may be forced with satisfaction.

Although no rules can be given for the time required in forcing, it is knowledge not hard to acquire with even surprising exactness. Nothing is likely to require more than three months in houses ranging from 45° to 55° F.—i.e., after bringing in from the pits. A month or six weeks is good time to allow in February and March, but with the same plants and temperatures, more time would be needed earlier; with the advance of the season, the work is quicker and less uncertain. There is a great difference in plants. Rhododendrons (the hybrids) require eight weeks or more, but one species will often bloom in March, within twenty-four hours. Plants like the rose, which must make a growth before the buds form, take more time than *Rhododendron sinense*. The difference between dull and bright weather is an important factor, but with extra firing, or the use of the forcing-box, these matters even up, and the average time of flowering is wonderfully even. In this work, a man with good plant sense is most likely to succeed.

1558. Forced trillium.

The use of anesthetics in forcing.

In the latter part of the last century and early in the present, experiments were begun in Germany, and confirmed in France, England and the United States, in subjecting plants to the influence of ether and chloroform for the purpose of securing better results in forcing. Ether seems, for many reasons, the most practical agent, but, owing to its cost and the extra expense of handling the plants, this process does not appear to be in common use among florists. For a detailed treatment of this subject, the reader is referred to an article by M. Emile Lemoine in the Journal of the Royal Horticultural Society (London), Vol. XXVIII, 1903–4, p. 45. See, also, the article *Etherization*, p. 1146, Vol. II.

In the main, the treatment of plants for this purpose is as follows: A container, which can be hermetically sealed and of the proper size is provided. In it are placed the plants "as dry as possible, in equally dry sand." The temperature of the box is 62° to 65° F. Under the lid is a vessel into which the ether can be poured and the hole sealed at once. It is important to have the ether at the top as its vapor is heavier than air and consequently gravitates downward. Ether,

particularly when mixed with air, is very inflammable and lighted matches, cigars or pipes must be kept away. "Thirty or forty grammes of ether are enough for one hundred cubic litres of air: one gramme equals fifteen and one-half grains, one litre equals sixty-one cubic inches." The ether used is "pure sulfuric ether which boils at 95° F." The plants are kept under the influence of the ether for two days; sometimes they are removed for two days and the etherization repeated for the same length of time. Afterwards they are placed in a coldhouse and "treated in the usual manner." Lilacs "were in full flower eighteen days after being placed in the greenhouse," one, "Marie Legraye still earlier." Johannsen made lilacs "flower regularly" the first two weeks in September which had been etherized the first week in August." With other shrubs, such as *Rhododendron sinense* (*Azalea mollis*), *Viburnum Opulus*, *Prunus triloba*, *Deutzia gracilis* and some of the spireas, the results were more or less favorable."

Trials with chloroform apparently have been less successful and other anesthetics and stimulants have been found failures. B. M. WATSON.

FORESTIÈRA (after Forestier, a French physician). Syn. *Adèlia*. *Oleàceæ*. Sometimes grown as ornamental shrubs.

Deciduous, rarely evergreen trees or shrubs: lvs. opposite, entire or serrate: fls. dicœcious, apetalous, with or without calyx, in small, axillary clusters in early spring, before the lvs.; stamens 2–4: fr. a small, mostly black, 1- or 2-seeded drupe.—About 15 species from Ill. south to Brazil and the W. Indies.

The species in cultivation are shrubs with rather small leaves, inconspicuous yellowish flowers before the leaves and small dark purple or black, berry-like fruits. *F. acuminata* is hardy in sheltered positions as far north as Massachusetts, while *F. ligustrina* is somewhat tenderer. They prefer moist soil and are suited for planting along streams. Propagation is by seeds and layers.

acuminàta, Poir. (*Adèlia acuminàta*, Michx.). Deciduous shrub, to 10 ft. high, sometimes spiny, glabrous: lvs. slender-petioled, ovate-oblong or ovate-lanceolate, remotely serrate, 1½–4 in. long: staminate fls. in dense clusters; pistillate fls. in short panicles: fr. narrow, oblong or cylindrical, deep purple, falcate, acute, ½in. long. W. Ill. to Texas. Michx. Fl. Bor. Amer. 2:225. B.B. (ed. 2) 2:728.

ligustrina, Poir. (*Adèlia ligústrina*, Michx.). Deciduous shrub, to 6 ft., pubescent: lvs. elliptic-obovate to oblong, obtuse, appressed-serrulate, about 1 in. long: fls. in fascicles: fr. sessile, ovoid, obtuse, ¼in. long. Tenn. to Fla. and Ala.

F. néo-mexicàna, Gray (A. parvifolia, Coville). Shrub, to 10 ft.: lvs. spathulate, almost entire, usually glabrous, grayish green and rather small: fr. ovate or short-oblong, obtuse, ½in. Texas to New Mex. and Colo. ALFRED REHDER.

FORESTRY is the rational treatment of forests; this treatment may vary with the object in view. Forests may subserve various objects, giving rise to three classes of forests: they furnish wood materials for the arts—*supply forests;* they furnish a soil cover, which may prevent the blowing of the soil and formation of sand-dunes, or may retard the erosion and washing of the soil and may regulate the waterflow, or act as a barrier to cold or hot winds, and exercise other beneficial influences on climate and surroundings—*protection forests;* or, finally, they furnish enjoyment to the esthetic and sporting elements in man, as game-preserves and parks—*luxury forests*. Any two or all three objects may be attained simultaneously in the same forest. In the end, and in a more limited sense, forestry is the art and business of making revenue from the growing of wood crops, just as all agriculture is finally concerned in producing values from food crops and other crops. In the economy of agriculture, wood crops may be grown on land that is too poor for field crops.

This art is divided into two distinct and more or less independent branches, namely silviculture, the technical branch, and forest management, the business branch. Silviculture is a branch of the larger subject arboriculture, and comprises all the knowledge and skill applied in producing the wood crop, relying mainly on natural sciences. While horticulture and silviculture have both to deal with trees, their object and with it their treatment of trees are totally different: the orchardist works for the fruit of the tree, the landscape gardener for the pleasing form; in both cases the object is attained by the existence of the tree and its single individual development; the forester is after the substance of the tree, the wood; his object is finally attained only by the removal of the tree itself. He deals with masses of trees rather than individuals: it is logs in quantity and of desirable quality, clear of knots, not trees, that he is working for; hence, his treatment differs from that of the horticulturist.

The clear long boles free of knots are secured by a dense stand, when by the shade of neighbors the lower branches are made to die and break off. When in this way clear boles to a certain height are secured, the stand is opened up by thinnings in order to secure expansion of crown and thereby more rapid increase in diameter of bole. There are several ways of reproducing the crop, namely artificially by sowing or planting, the latter being done with one- to four-year-old plants, at the rate of 1,500 to 4,000 to the acre; or by natural regeneration, either by sprouts from the stump, the so-called coppice, which is applicable to hardwoods and for the production of fuel wood and small-dimension material, or else by seed from mother or nurse trees. There are various procedures of securing a crop by seed, a so-called timber forest, which differ by the rapidity of the removal of the old crop or nurse trees, and by the size and progress of the opening—strip system, group system, selection system, and, the most refined, shelterwood system.

Since the crop takes many years to mature—sometimes a century and more—in order to carry on a continuous forestry business, from which to secure annual returns, special arrangements peculiar to this business must be made: these arrangements, naturally influenced by the economic conditions of the country, form the subject of forest organization or management.

The ideal of the forester to which he attempts a gradual approach with his actual unregulated forest is known as the "normal forest." It supposes that a rotation has been chosen, i.e. a year or period when the timber will be ripe (determined in various ways); that as many stands are at hand as there are years in the rotation, differing by one year from each other, so that each year a mature area can be harvested—a normal age-class gradation; that the increment on the whole area is the best attainable for species and site—a normal increment; that the amount of wood standing, the stock on which the increment is deposited, is the proper one for each age-class—a normal stock. This is the standard with which the actual forest is compared to judge its abnormalities, which by the management are to be, as far as practicable, removed.

Since the forest crop takes from thirty to one hundred years and more to mature, i.e., to produce desirable size, highest value, or best interest rate on the investment, it is a business which does not appeal to private enterprise: the long-time element, as well as the influence of forests on water-flow and other cultural conditions make forestry particularly a business to be conducted by the state or other long-lived corporation.

The horticulturist, as such, is mainly interested in the rational treatment of such forests as have a protective value, influencing climatic, soil and water conditions in general and locally.

The raising of trees for shade, for ornament, and for avenues is not forestry, but a branch of arboriculture (which see); the ornamental utilization of forests, as a part of grounds, is discussed under *Woods*.

B. E. FERNOW.

FORGET-ME-NOT: *Myosotis.*

FORMAL GARDENING: *Landscape Gardening.*

1559. Flowers of Forsythia suspensa var. Fortunei. (×⅔)

FORSÝTHIA (after William Forsyth, prominent English horticulturist, director of the Royal Garden at Kensington, 1737–1804). *Oleàceæ.* GOLDEN-BELL. Shrubs grown for their wealth of bright yellow flowers appearing early in spring, also for their handsome dark green foliage.

Deciduous: lvs. opposite, petioled, serrate or entire, simple or partly 3-parted to 3-foliolate: fls. 1–6, axillary, pedicelled, heterostylous; calyx and corolla deeply 4-lobed, lobes of the corolla oblong, longer than the campanulate tube; stamens 2, included, inserted at the base of the corolla; ovary superior; style slender with 2-lobed stigma: fr. a 2-celled, dehiscent caps. with many winged seeds.—Four species in China, Japan and S. E. Eu.

The golden-bells are highly ornamental, free-flowering shrubs, with simple or ternate leaves and showy yellow flowers, borne in great profusion along the slender branches in early spring before the leaves. They belong to the showiest early-flowering shrubs, and have handsome, clean foliage, remarkably free from insects or fungi, remaining unchanged until late in fall. The upright forms are well adapted for the borders of shrubberies and the pendulous form for covering walls, fences, arbors or porches. They grow in almost any kind of garden soil, and are hardy North except *F. viridissima*, which is somewhat tenderer. Propagation is readily by greenwood and hardwood cuttings; also by seeds. The branches of the pendulous form often take root at the tips when touching the ground, and send forth vigorous shoots, like some brambles or the walking-fern.

A. *Lvs. often 3-parted or 3-foliolate: branches hollow between the nodes (except in the hybrid).*

B. *Branches always hollow between the nodes: lvs. usually ovate, often 3-foliolate.*

suspénsa, Vahl. Shrub, to 8 ft., with slender branches often lopping on the ground and taking root: lvs. broad-ovate or oblong-ovate, serrate, 3–4 in. long: fls. 1–3, rarely to 6, about 1 in. long, golden yellow, tube striped orange-yellow within; calyx about as long as tube: caps. ovate, about 1 in. long. China. S.Z. 3. Gn. 73, p. 243. Var. **Fórtunei,** Rehd. (*F. Fórtunei*, Lindl.). Fig. 1559. Of upright habit with finally arching branches: lvs. often ternate, ovate or oblong-ovate: corolla with straight and spreading twisted segms. R. H. 1861:291. G. 4:79; 13:87. G.M. 50:227. F.E. 31:421. Var. **decípiens,** Koehne. A vigorous form of the preceding: fls. always solitary, on pedicels usually ½in., sometimes nearly 1 in. long, deep yellow, known only in the macrostylous form. Gt 55, p. 203 Var **pállida,** Koehne. Fls. always solitary, pale yellow. Var. **variegàta,** Butz. Lvs. variegated with golden yellow: fls. deep yellow. Var. **atrocaùlis,** Rehd. A form of var. *Fortunei* with dark purple branches and the young growth purplish. Cent. China. Var. **pubéscens,** Rehd. Similar to the preceding, but lvs. soft and short-pubescent on both sides or only below. Cent. China. Var. **Sièboldii,** Zabel (*F. Sièboldii*, Dipp.). Fig. 1560. Low shrub, with very slender, pendulous or trailing branches: lvs. mostly simple, broad-ovate or ovate: corolla-lobes flat and broad, slightly recurved. B.M. 4995. F.S. 12:1253. Gn. 33, p. 563. A.G. 13:94. G.F. 4:79. Gt. 55, p. 205.—*F. suspensa* is an excellent shrub for the margins of groups, because it finally rolls over and meets the greensward. It can also be trained over an arbor.

1560. Forsythia suspensa var. Sieboldii. (×½)

BB. *Branches usually, particularly above, with lamellate pith between the nodes, pith at the nodes usually solid: lvs. only on vigorous shoots partly 2–3-parted or sometimes 3-foliolate, usually ovate-lanceolate.*

1561. Flowers of Forsythia viridissima. (×⅔)

intermèdia, Zabel (*F. suspénsa* × *F. viridissima*). Shrub, with slender, erect or arching branches: lvs. oblong to ovate-lanceolate, sometimes 3-lobed or ternate, usually coarsely serrate, 3–4 in. long: fls. almost like those of *F. suspensa* var. *Fortunei*. Gt. 1885:1182; 40, p. 397. Gn.W. 22:181. Var. **vitellìna,** Koehne (*F. vitellìna*, Koehne). With upright or spreading branches: fls. deep yellow, little over 1 in. long. Gt. 55, pp. 227, 228. Var. **spectábilis,** Spaeth (*F. spectábilis*, Koehne). Upright with spreading and somewhat arching branches: fls. somewhat paler than of the preceding, 1½ in. long, often 5–6-merous. Gt. 55, p. 229. G. 35: 255. Var. **densiflòra,** Koehne (*F. densiflòra*, Koehne). Upright shrub with divaricately spreading and slender arching branches: fls. crowded at the base of the branches, rather pale with flat slightly recurved corolla-lobes. Gt. 55, pp. 230, 231. Var. **primúlina,** Rehd. Upright shrub, with spreading and arching branches: fls. crowded at the base of the branches, pale yellow; lobes of the corolla revolute at the margin.—

F. intermedia is often confounded with forms of *F. suspensa*. In foliage it resembles much the following, which has the lvs. narrower, always simple, usually serrate only above the middle, with smaller teeth. It is as hardy as *F. suspensa* and very floriferous.

1562. Forsythia viridissima. (×½)

AA. *Lvs. always simple: branches, at least in their upper part, with lamellate pith throughout, including the nodes: habit upright.*

viridíssima, Lindl. Figs. 1561, 1562. Shrub, to 10 ft., with green, erect branches: lvs. oblong-lanceolate or lanceolate, always simple, and generally serrate only above the middle, very dark green, 3–6 in. long: fls. 1–3, about 1 in. long; corolla with rather narrow, twisted lobes of bright, somewhat greenish yellow; calyx about half as long as tube. China. B.M. 4587. F.S. 3:261. B.R. 33:39. H.F. 1852: 97. J.H. III. 65:423. Gn. 33, p. 563. G.2:65;28:39. A.G.13:94. Var **variegàta**, Hort. Lvs. variegated with white.—Less hardy and graceful than the preceding forms.

europæa, Degen & Baldacci. Upright shrub to 6 ft.: lvs. usually ovate to ovate-lanceolate, entire or at the end of vigorous shoots with shallow teeth, 2–3 in. long: fls. 1–3, about 1 in. long, short-pedicelled, golden yellow; calyx-lobes ovate-ciliate, shorter than the corolla-tube: caps. ovoid, about ½in. long. Albania. B.M. 8039. Gt. 54, p. 291. G.C. III. 36:123. J.H.S. 29: 663. F.E. 18:348.

F. Giraldiàna, Lingelsh. Upright shrub: lvs. elliptic to oblong, long-acuminate, broadly cuneate at the base, entire or serrulate, glabrous or hairy on the veins beneath, 2–5 in. long: fls. short-stalked: caps. ovoid with a long and slender beak. N. W. China.

ALFRED REHDER.

FORTUNEÀRIA (after Robert Fortune, who traveled during the years 1843–61 in China and Japan and introduced a large number of highly ornamental plants). *Hamamelidàceæ*. Ornamental shrub, grown for its handsome foliage.

Stellate-pubescent: lvs. deciduous, alternate, serrate, with small caducous stipules: fls. small, short-pedicelled, in terminal racemes; calyx turbinate with 5 short lobes; petals 5, subulate, slightly shorter than sepals; stamens 5, with short filaments; ovary partly superior with 2 filiform revolute styles: fr. a dehiscent woody caps., separating into 2 valves bifid at the apex; seeds glossy, dark brown; embryo with large cotyledons revolute at the margin.—One species in Cent. China. Very similar in habit and foliage to Sinowilsonia, but the fls. and the embryo are very different. In general appearance it suggests the hazel; fls. and frs. insignificant. Has proved hardy at the Arnold Arboretum. Prop. is by seeds and possibly by grafting on Hamamelis.

sinénsis, Rehd. & Wilson. Shrub to 6 ft.: lvs. obovate or obovate-oblong, short-acuminate, usually rounded at the base, sinuate-denticulate, glabrous above, pubescent on the veins below, 3–5½ in. long: fls. scarcely ⅛in. across in racemes about 2 in. long: caps. ovoid, less than ½in. long. May. Cent. China.

ALFRED REHDER.

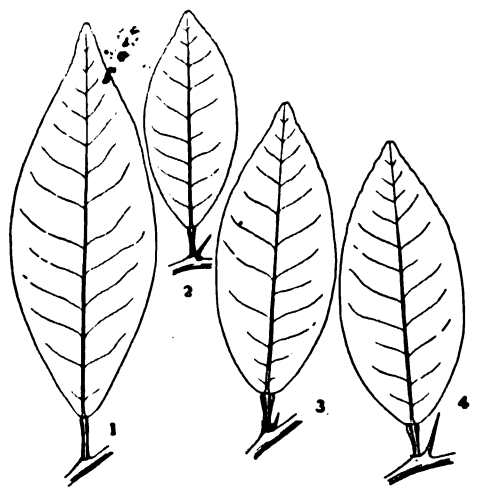
FORTUNÉLLA (named for Robert Fortune, who in 1846 introduced the first kumquat into Europe). *Rutàceæ*, tribe *Citreæ*. KUMQUAT. Evergreen shrubs, grown for their small ornamental fruits, which are also preserved and eaten fresh. See *Kumquat*.

Leaves unifoliate, thick, pale and densely glandular-dotted below: stamens 4 times as many as the petals, polyadelphous; ovary 3–6- (rarely 7-) celled, ovules 2 in each cell; stigma cavernous: frs. like Citrus but smaller, 1–1½ in. diam., globose or oval, skin usually thick, sweet and edible; seeds green in section, cotyledons hypogeous in germination: first foliage-lvs. broadly ovate, opposite. Differs from Citrus in having a few-celled ovary with only 2 ovules in a cell, and a cavernous stigma; from Atalantia in having 4 times as many stamens as petals.—Four species are recognized.

The two commonly cultivated species of kumquats have been referred by botanists to Citrus, but the obviously related Hongkong wild kumquat has been referred to Atalantia. The kumquats are, as a matter of fact, out of place either in Citrus or Atalantia and constitute a separate genus about midway between these two. See Journ. Wash. Acad. Sci. 5:165–176 (No. 5, March 4) 1915.

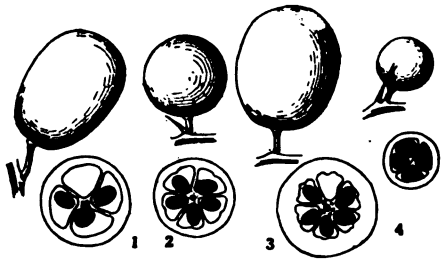
A. *Subgenus Eufortunella. Fr. 4-, 5-, 6- (or rarely 7-) celled, pulp vesicles abundant, their stalks arising from the smooth ovary wall, peel of fr. thick and fleshy. The kumquats proper.*

margaríta, Swingle (*Citrus margarìta*, Lour.). Figs. 1563, 1564. OVAL KUMQUAT. NAGAMI KUMQUAT. A shrub or small tree, thornless or nearly so: twigs slender, angled when young, often somewhat tufted: lvs. lanceolate, tapering toward both ends, the tip abruptly rounded, sometimes emarginate, the base cuneate, margin usually obscurely crenate above the middle, dark green above, veins scarcely visible, pale green and densely glandular-punctate below: fls. arising singly or in few-fld. clusters in the axils of the lvs., small, ⅖–⅗in. diam.; pedicel short, 1½–2½ lines long; bud more or less angular in cross section; pistil short, 2–2½ lines; style persistent, scarcely longer than the ovary; stigma capitate, cavernous, with large, deep-seated oil-glands between the stylar canals; ovary 4- or 5-celled, ovules 2 in a cell, usually collateral: frs. oval or oblong, 1–1⅕ x ⅘–1 in., rarely 1⅕–1½ in. long, yellowish orange with large translucent oil-glands imbedded in the thick and fleshy skin; pulp-vesicles abundant, fusiform, pulp acid; seeds large, 5–6 x 3–3½ x 2–2½ lines, oval; embryos one or several, pistache-green in section; germination with hypogeous cotyledons: first foliage-lvs. opposite,



1563. Leaves of Fortunella. (×½) 1, F. margarita; 2, F. japonica; 3, F. crassifolia; 4, F. Hindsii.

oval, narrowed at the base but without a sharply delimited jointed petiole. B.M. 6128. G.C. II. 2:336. Hume, Citr. Fr. p. 129.—The oval kumquat, the type of the genus Fortunella, is the most vigorous member of the genus, the branched shrub or tree attaining a height of 10–12 ft. and the lvs. sometimes reaching 6 in. length



1564. Fruits with cross-sections of Fortunella. (×½) **1, F. margarita; 2, F. japonica; 3, F. crassifolia; 4, F. Hindsii.**

and 2 in. width. It was the first kumquat to reach Eu., having been brought to England by Robert Fortune in 1846. Because of its superior vigor it is the one most commonly grown commercially, but the frs. are inferior to those of the following species, the skin being harsh in flavor because of the biting quality of the oil.

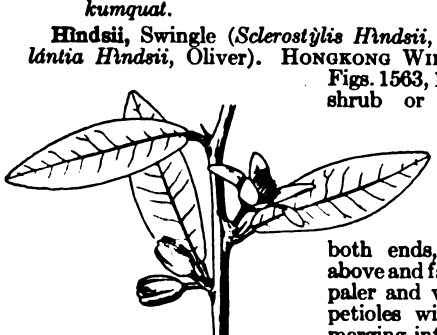
japónica, Swingle (*Citrus japónica*, Thunb.). ROUND KUMQUAT. MARUMI KUMQUAT. Figs. 1563–1565. A much-branched shrub with very short spines or none: differs from *F. margarita* in the broader and blunter pointed smaller lvs., 1⅗–4 x ⅗–1⅘ in., paler and veinless below, round frs. ⅝–1⅕in. diam., not showing any persistent rudiment of the style, and usually with 5–6 segms.: seeds small, 3½–5 x 3–3½ x 2–2½ lines, oval, blunt-pointed, the empty testa not projecting beyond the end of the embryo. Ill. Rumph. Herb. Amb. 1:110, pl. 31. Thunb. Icon. Pl. jap. 2, pl. 5. Hume, Citr. Fr. p. 129.—The round kumquat is perhaps the most handsome of the citrous frs. because of its dwarf habit, much-branched twigs, and small, bright orange-colored frs.

crassifòlia, Swingle. MEIWA KUMQUAT. Figs. 1563, 1564. A much-branched shrub with very short spines or none: differs from *F. margarita* in the more rounded frs. 1–1½ x 1–1⅛ in., with 6 or 7 cells, not 4 or 5, and in the thicker trough-shaped lvs. sometimes more abruptly pointed toward the tip, and paler green below: petioles narrowly winged, not merely margined. It differs from *F. japonica* in the lf. characters and the slightly oval frs. with 6 or 7 cells and a thicker peel. It differs from both species in having much broader oval or ovate pulp-vesicles.—This kumquat recently intro. into the U. S. by Japanese nurserymen is as yet but little known.

AA. *Subgenus Protocitrus. Fr. 3–4-celled, having between the stalks of the pulp-vesicles many minute wart-like, pale yellow cellular masses, peel of fr. thin and but slightly fleshy. The Honokong wild kumquat.*

Hindsii, Swingle (*Sclerostylis Hindsii*, Champ. *Atalántia Hindsii*, Oliver). HONGKONG WILD KUMQUAT. Figs. 1563, 1564. A spiny shrub or small tree: twigs slender, angled when young: lvs. oval-elliptical, tapering sharply at both ends, dark green above and faintly venose, paler and venose below, petioles winged, often merging into the lamina of the lf. without a separative joint: fls. short, broad; pistil very short; style shorter than the ovary, stigma large, cavernous; ovary 3- or 4-celled, ovules 2 in a cell: frs. small, ⅗–⅘in. subglobose, bright orange-red; pulp-vesicles very few, small, fusiform; seeds thick, oval or ovate, plump, 4½–5½ x 3½–4 x 2½–3 lines, pistache-green in section. Ill. Seeman, Bot. Voy. H. M. S. Herald, 1852–1857, pl. 82.—The Hongkong wild kumquat grows commonly on the dry hills about Hongkong and on the mainland of China opposite. It is the most primitive of the true citrous frs. and doubtless the species of Citrus have evolved from such a plant.

WALTER T. SWINGLE.



1565. Buds and flower of Fortunella japonica.

1566. Fothergilla.—Leaves of F. Gardenii and flowers of F. major. (×½)

FOTHERGÍLLA (after John Fothergill, eminent English physician, who introduced and cultivated many new plants, 1712–1780). *Hamamelidàceæ*. DWARF ALDER. Shrubs, chiefly grown for their showy spikes of white flowers and also for the handsome foliage.

Deciduous, more or less stellate-pubescent: lvs. alternate, short-petioled, coarsely toothed, stipulate: fls. in terminal spikes, perfect, apetalous; calyx campanulate, 5–7-lobed; stamens numerous, with the filaments thickened toward the end: caps. dehiscent, 2-celled and 2-seeded.—Four species in the southern Atlantic states.

These are hardy ornamental shrubs with simple, dull green leaves, and showy spikes of white flowers in spring with the leaves: the distinct foliage resembles somewhat that of the alder, or more that of Hamamelis, and turns yellow late in fall. They grow best in moist, peaty or sandy soil. Propagation is by seeds, not germinating until the second year, or by layers, which take two years to root; the first species also by suckers and root-cuttings.

A. *Lvs. rarely exceeding 1 in., stellate-pubescent above: low shrub.*

Gárdenii, Murr. (*F. alnifòlia*, Linn. f. *F. carolìna*, Brit.). Fig. 1566. Low shrub, with generally spreading branches, to 3 ft.: lvs. oblong or obovate, rounded or cuneate at the base, coarsely dentate above the middle, pubescent above, pale or glaucous and tomentose below, 1–2 in. long: spikes ovate or oblong, 1–2 in. long, leafless at the base; stamens ⅓in. long, sometimes pinkish. April, May. Va. to Ga. B.M. 1341. L.B.C. 16:1507.

AA. *Lvs. 2–5 in. long, glabrous or glabrescent above: shrubs to 10 ft. high.*

monticola, Ashe. Fig. 1567. Upright shrub with spreading branches: lvs. roundish oval to broadly obovate or obovate, remotely dentate, often from below the middle, light green and sparingly pubescent below, often only on the veins, 2–4 in. long: spikes 1½–3 in. long with 1–3 lvs. at the base; stamens ½in. long: caps. ½in. long. April, May. N.C. to Ala.—Has proved hardy at the Arnold Arboretum, like the preceding and the following species.

1567. Fothergilla monticola. (×⅓)

màjor, Lodd. (*F. alnifòlia* var. *màjor*, Sims). Fig. 1566. Upright shrub of dense pyramidal habit: lvs. oval or obovate, cordate or truncate at the base, sinuately dentate above the middle or nearly entire, dark green and somewhat glossy above, glaucous and more or less stellate-pubescent below, at least on the veins, of firm texture, 2½–5 in. long: fls. like in the preceding species. April, May. Known only from cult. plants. B.M. 1342. L.B.C. 16: 1520. G.F. 8:445 (excl. lvs. and frs.). M.D.G. 1902:395, 396.—This species is superior to the former on account of its dense, pyramidal habit.

F. parviflòra, Kearney. Closely related to F. Gardenii. Lower and stoloniferous: lvs. nearly orbicular, rounded or cordate at the base, toothed from below the middle. N. C. to Fla.

ALFRED REHDER.

FOUQUIÈRIA (Pierre Ed. Fouquier, professor of medicine at Paris in the first part of the nineteenth century). *Fouquieriàceæ*. CANDLEWOOD. Four species from the deserts of Mexico and one extending into the United States and sometimes cultivated in the larger rockeries of California. These plants are interesting as being an example of an order far removed from the Cactaceæ in flowers and fruit but reduced to something of their habit by the desert conditions.

Small trees or shrubs, becoming leafless in dry weather, with showy tubular fls. in terminal racemes or panicles: lvs. fleshy, obovate, fascicled in the axils of thorns: sepals 5; corolla with a spreading 5-lobed limb; stamens 10-∞; styles 3, separate or united: seeds with a membranous wing or fringed with long hairs. Fouquieria is by some authors retained in the Tamaricaceæ.

spléndens, Engelm. COACH-WHIP. VINE-CACTUS. JACOB'S STAFF. OCOTILLO. Shrub, 6–25 ft., branching near the base: branches long, gray, furrowed, erect: lvs. obovate, rounded at apex, wedge-shaped at base, ½–1 in. long: fls. scarlet or brick-red, exceeding 1 in. long, in racemose or thyrsoid elongated clusters; stamens 8–12, exserted: caps. ½–⅔in. long, the seeds white, with a long fringe of spirally thickened hairs. W. Texas and Ariz. to S. Calif. B.M. 8318. A.G. 13:759.—A hedge plant in Mex., making an impentrable barrier. The plant is a conspicuous object in the deserts from Texas westward, standing on the open exposed places and slopes, the rod-like stiff canes looking like lifeless sticks in dry weather and in its season crowned with masses of showy bloom. L. H. B.†

FOURCRÒYA: *Furcræa.*

FOUR-O'CLOCK: *Mirabilis Jalapa.*

FOXGLOVE: *Digitalis.*

FRAGÀRIA (Latin, fragrance, from the smell of the fruit). *Rosàceæ*. STRAWBERRY. Low perennial creeping herbs grown for the excellent fruit, and one or two species for ornament.

Plant stemless, with scaly rootstock or crown, and rooting runners: lvs. palmately 3-foliolate and toothed, all from the crown: fls. white or reddish, in corymbose racemes on slender, leafless scapes, sometimes lacking stamens; calyx deeply 5-lobed and reinforced by 5 sepal-like bracts; petals 5, obovate, elliptic or orbicular; stamens many, short; pistils many, on a conical receptacle, becoming small and hard achenes and persisting on the enlarging receptacle, which becomes pulpy and edible.—The fragarias are exceedingly variable. About 150 specific names have been applied to them, but Bentham and Hooker would reduce them all to 3 or 4 species, and Focke (in Engler & Prantl) to about 8. Rydberg, however, accepts 27 N. American species (N. Amer. Flora, XXII, part 4. 1908). Of the true fragarias, about 4 species-types are interesting to the horticulturist as the parents of the garden strawberries:—*F. chiloensis*, the probable original of the ordinary cultivated strawberries of Amer.; *F. virginiana*, which was early domesticated, and of which some trace still remains in cult. varieties; *F. moschata*, the Hautbois, and *F. vesca*, the alpine and perpetual strawberries, which are little cult. in this country. The classical work on straw-

1568. Fragaria chiloensis.

1569. Fragaria virginiana, showing the profuse runners.

berries is Duchesne's "Histoire Naturelle des Fraisiers," 1766. See *Strawberry*. For *Fragaria indica*, see *Duchesnea*.

A. *Lfts. distinctly petiolulate, few-toothed.*

Daltoniàna, Gay (*F. sikkiménsis*, Kurz). Small plant with red sts. to the very slender runners, offered as a rock-garden subject or carpeter: hairy or nearly glabrous: fls. solitary; calyx-lobes and bracts toothed: fr. long (1 in. long by half as broad), bright scarlet, with little flavor. Himalayas, 10,000 ft. and upward.

AA. *Lfts. sessile or nearly so, many-toothed.*

B. *Lvs. normally overtopping the fls. and fr.: achenes mostly sunken in the flesh of the berry.*

chiloénsis, Duchesne. Fig. 1568. Low, but stout in all its parts: lvs. thick, more or less glossy above, bluish white below, blunt-toothed: fl.-clusters forking and long-rayed, the peduncle short, soon lopping on the ground: runners mostly appearing after the fr. is gone: berry large and firm, dark-colored, more or less musky in flavor, reinforced by a very large calyx or hull. Pacific coast region Peru to Patagonia. —A common wild strawberry of the Pacific slope from Alaska to Calif., is considered to be the same species.

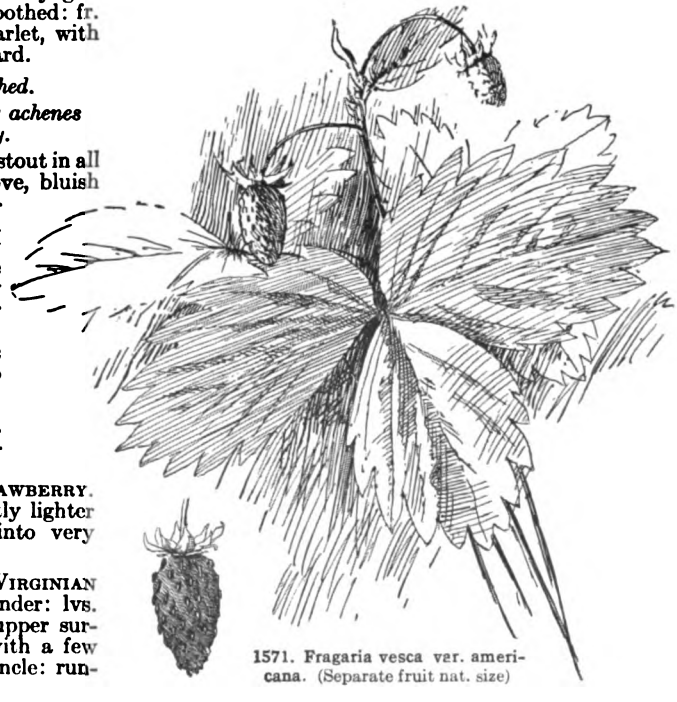
Var. **ananássa,** Hort. (*F. ananássa, F. tíncta, F. calyculàta,* Duchesne. *F. grandiflòra,* Ehrh. *F. vésca* var. *anànas,* Ait.). Pine Strawberry. Common Garden Strawberry. Taller growing: lvs. larger and thinner, mostly lighter green on both sides: fr. larger, running into very many kinds.

virginiàna, Duchesne. Scarlet or Virginian Strawberry. Figs. 1569, 1570. More slender: lvs. thinner, light green above and below, the upper surface with sunken veins: fl.-clusters small, with a few hanging frs. at the top of a rather long peduncle: runners usually appearing with the fr.: berry small, light scarlet, globular or oblong-conical, usually with a constriction or neck underneath the moderate-sized calyx or hull. E. N. Amer.—Variable. A few early varieties of strawberries, as Crystal City, seem to be wholly or partly of *F. virginiana* origin. Var. **illinoénsis,** Gray (*F. illinoénsis*, Prince. *F. Grayàna,* Vilm. *F. virginiàna* var. *Grayàna,* Rydb.). A large and more robust form, more hairy, the hairs on the pedicels spreading whereas on the type they are more appressed.

BB. *Lvs. normally shorter than the fl.-clusters: achenes usually not sunken in the flesh of the berry.*

1570. Fruit of Fragaria virginiana. (Nat. size)

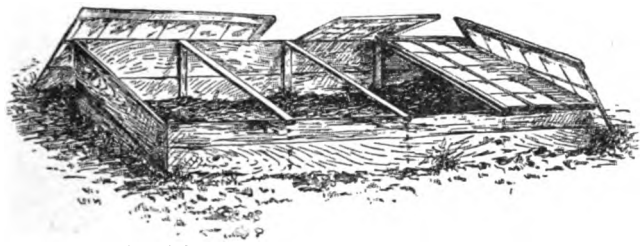
vésca, Linn. (*F. semperflòrens,* Duchesne). Alpine and Perpetual Strawberries. Erect and dark green, only sparsely hairy, the lvs. thin and light green as compared with the foregoing species, very sharp-toothed: fl.-cluster small, forking, erect: fr. firm, small, usually hemispheric, the achenes very prominent; hull spreading. Eu.—The American more slender form of this group-species, common in woods from Va. north, is var. **americàna,** Porter (*E. americàna,* Brit.), Fig. 1571, with ovoid or somewhat conical fr. usually with a distinct neck, and sparingly hairy rather than hairy-pubescent petioles and scapes, and thinner lvs. The true *F. vesca* is thought to be sparingly naturalized eastward, and probably native in many parts, particularly the white-fruited form (forma *albicárpa,* Brit.). The cult. forms are rarely seen in this country, but the quality is high, and they are deserving of more attention in home grounds. Variable in cult. There is a form with lfts. reduced to 1 (*F. monophýlla,* Duchesne. B.M. 63). This type of strawberry bears more continuously than *F. chiloensis* and *F. virginiana* in its cultivated forms.



1571. Fragaria vesca var. americana. (Separate fruit nat. size)

moschàta, Duchesne (*F. elàtior*, Ehrh.). HAUTBOIS. Taller, usually dicœcious, more pubescent, the calyx or hull strongly reflexed from the fr.: berry dull red, musky. Eu.—Cult. forms rarely seen in Amer.

mexicàna, Schlecht. Lvs. few and scape solitary: lvs. rather thin, soon becoming smooth above, the slender silky petioles 2–3 in. long; lfts. oblong-obovate or cuneate, coarsely serrate: fls. usually less than ½in.



1572. A frame.—It accommodates four sashes.

diam., on scapes 2–4 in. high; sepals and bracts silky; petals obovate: fr. nearly hemispheric, small, the achenes superficial. Cent. Mex.—The "everbearing strawberry," frequently advertised, is said to belong here. *F. californica*, Cham. & Schlecht., is similar but has much longer petioles and broadly rounded or rhomb-ovate lfts., somewhat larger fls. and fr., and the achenes in shallow pits. Calif., New Mex., Lower Calif.

L. H. B.

FRAGRANT BALM: *Monarda didyma.*

FRAME. Fig. 1572. A box without permanent top or bottom which is designed, when covered with glass or other transparent material, as a place in which to grow plants. When supplied with artificial bottom heat, the frame is part of a hotbed; when supplied only with sun heat, it is part of a coldframe. The frame may be of any size, but the normal size is 6 by 12 feet, an area which accommodates four 3- by 6-foot sashes; and this 6 by 12 area is understood when one speaks of "a frame." See *Hotbed.*

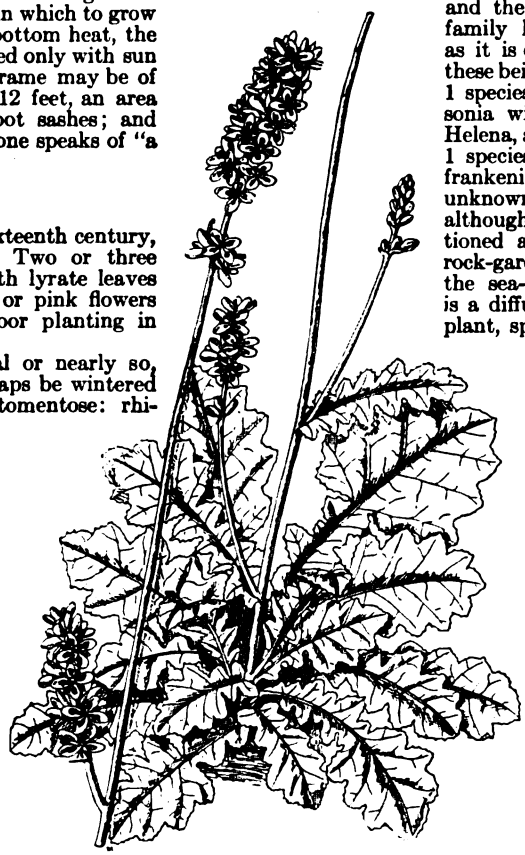
FRANCISCEA: *Brunfelsia.*

FRANCÒA (Fr. Franco, Valencia, sixteenth century, promotor of botany). *Saxifragàceæ.* Two or three species of Chilean perennial herbs, with lyrate leaves and terminal dense racemes of white or pink flowers borne in summer, suitable for outdoor planting in mild climates.

Plants erect, scapose, the lvs. basal or nearly so, 2–3 ft. high, and in the N. could perhaps be wintered in a coldframe: glandular-pilose or tomentose: rhizome thick, many-headed: lvs. glandular-dentate: fls. 1 in. across, in racemes 6 in. long; floral parts in 4's rarely 5's; petals obovate, clawed; stamens 4: caps. coriaceous, elongated, 4-angled and 4-celled.

A. *Fls. white.*

ramòsa, D. Don. (*F. glabràta*, DC.). Taller, woodier and more branching than the others, and distinguished by pubescent infl.: lf.-stalks not margined: fls. smaller. Hardy at Washington, D. C., with spikes 2 ft. long and 1 in. thick. Forms are known under the names *F. ramosa hybrida* (G.W. 7:230, a robust plant with pure white fls. larger than the type); and *F. ramosa candida. F. ramosa* is an attractive species. Gt. 60:1590. Gn. 69, pp. 271, 343; 70, p. 283. G.L. 24:177. G. 7: 741; 13:307. G.M. 49:127.



1573. Francoa sonchifolia. (×¼)

AA. *Fls. mostly pink.*

sonchifòlia, Cav. Fig. 1573. Lf.-stalks broadly winged at the base; lower lobes continuous with the broad margin at the base of the lf.-stalk: petals deep rose, dark-spotted. B.M. 3309.—By some considered to be a variety of *F. appendiculata.*

appendiculàta, Cav. Lf.-stalks not winged at the base; lower lobes distant from the base of the stalk: petals pale rose, rarely spotted. B.M. 3178 (shows a white longitudinal band on petals). B.R. 1645. L.B.C. 19:1864, erroneously named *F. sonchifolia.* R.H. 1906, pp. 428, 429. G.W. 12, p. 260.

L. H. B.†

FRANGIPANI: *Plumeria.*

FRANKÈNIA (John Frankenius, Swedish botanist, 1590–1661). *Frankeniàceæ.* Low perennials, evergreen, sometimes woody, mostly in saline soils, more or less heath-like: lvs. opposite or in 4's, thickish, entire, small and numerous on the sts., often fascicled on short branchlets: fls. small, perfect and complete, sessile or nearly so, solitary or in dichotomous clusters; calyx and corolla 4–5-merous, the sepals united, the petals with a crown at the base of the blade; stamens usually same number as petals and alternate with them; style 3–4-cleft; ovary 1-celled, with parietal placentæ, ripening into a caps. inclosed in the calyx.—Probably 30 species in many parts of the world, a very few of them in the S. W. U. S. The family Frankeniaceæ is closly allied to Caryophyllaceæ, from which it differs in the parietal placentæ, and to Hypericaceæ, from which it differs in habit, in the definite stamens and the valvate calyx. The family has 3 other genera, as it is defined by Niedenzu, these being Hypericopsis with 1 species in S. Persia, Beatsonia with 1 species in St. Helena, and Niederleinia with 1 species in Patagonia. The frankenias are practically unknown as cult. plants, although sometimes mentioned as carpeters and for rock-gardens. *F. lævis*, Linn., the sea-heath, is offered. It is a diffusely much-branched plant, spreading 6–8 in., glabrous or nearly so: lvs. revolute and thereby appearing linear, crowded in opposite clusters: fls. few, sessile in terminal leafy clusters, pink. England and the Medit. region. *F. pulverulénta*, Linn., is a closely allied hairy species; it has been reported in ballast at New York.

L. H. B.

FRASÈRA (John Fraser, English botanist, collected in Amer. 1785–96 and published Walter's "Flora Caroliniana"). *Gentianàceæ.* COLUMBO.

Large stout glabrous herbs, all N. American, and all but 1 far-western with a single st. from thick bitter mostly biennial roots, opposite or whorled lvs., and cymose panicled clusters of dull white, yellowish or bluish fls. which are commonly dark-spotted; calyx deeply 4-parted; corolla wheel-shaped, 4-parted, persistent, the lobes glandular within; stamens 4, the filaments often united at the base; ovary 1-celled, the stigma entire or 2-lobed.—Species 8, mostly in woods or dry soils. Three of the species have been offered in the trade, but are probably very little planted. *F. carolinénsis*, Walt., of the eastern states and Ont., is a biennial or short-lived perennial, 3–4 ft. tall, with lance-oblong or spatulate veiny lvs. mostly in 4's, and greenish yellow purple-dotted fls.

A. *Lvs. in whorls of 4–6, not white-margined.*

speciòsa, Douglas. Stout, 2–5 ft., very leafy, the lvs. ovate to oblong: fls. greenish white or barely tinged bluish, dark-dotted; 2 glands on each corolla-lobe. Wyo., S. and W.

1574. **Fraxinus Bungeana.** (×⅓)

AA. *Lvs. in 2's or 3's, white-margined.*

Párryi, Torr. Height 2–3 ft.: lvs. opposite or in 3's: fls. whitish, dark-dotted; 1 notched gland on each corolla-lobe. Ariz., S. Calif.

Cûsickii, Gray. Slender, height 3–8 in.: lvs. opposite: fls. bluish; 1 gland reaching from near the base to near the middle of each corolla-lobe. Ore. L. H. B.†

FRAXINÉLLA: *Dictamnus.*

FRÁXINUS (ancient Latin name). *Oleàceæ.* ASH. Interesting trees grown chiefly for their handsome pinnate leaves and some species also for the conspicuous panicles of white flowers.

Deciduous: lvs. opposite, odd-pinnate, without stipules: fls. in panicles, dicecious or polygamous, with or without calyx or with calyx and a 2–6-parted corolla with generally linear segms.; stamens generally 2; ovary 2-celled: fr. a 1-seeded, winged samara.—About 50 species in the temperate regions of the northern hemisphere south to Cuba; 16 of them occur in the U. S.

The ashes are ornamental trees, most of them hardy, with rather large leaves and small flowers in panicles, either appearing before the leaves and greenish, or in the subgenus Ornus after or with leaves and whitish in showy panicles: the winged fruit is insignificant. They are valuable as street and park trees, and grow mostly into tall, pyramidal or broad-headed trees, with rather light green foliage, which turns yellow or dark purple in fall or remains green, as in *F. excelsior* and *F. Ornus*. The ash is seldom severely injured, though a number of insects and fungi prey on the leaves and wood, of which two borers, and a fungus attacking the leaves are perhaps the most obnoxious. Most of the species are hardy North except those from the southern states, southern Europe and Himalayas; of the subgenus Ornus, *F. Bungeana* and *F. longicuspis* seem to be the hardiest. The ashes are important forest trees, and the straight-grained and tough wood is much used for handles of tools, in the manufacture of carriages and wagons, for the interior finish of houses, and for furniture, for baskets and also for fuel. From *F. Ornus* manna is obtained as an exudation of the trunk, and some Chinese species, especially *F. chinensis* and *F. Mariesii*, yield the Chinese white wax.

The ashes grow in almost any moderately moist soil, *F. nigra* being somewhat more moisture-loving, while *F. oxycarpa*, *F. Ornus*, *F. syriaca* and *F. cuspidata* grow well even in drier situations. They are usually readily transplanted and grow rapidly when young. Propagation is by seeds gathered in fall and sown immediately, or stratified and sown in spring, covered with about 1 inch of good soil; sometimes they remain dormant until the second year. The varieties and rarer kinds are budded in late summer or grafted in spring on the seedlings of any of the common species.

INDEX.

acuminata, 9.
alba, 9.
albo-marginata, 9, 20.
albo-variegata, 20.
americana, 9.
angustifolia, 1.
anomala, 16.
argentea, 20.
asplenifolia, 20.
atrovirens, 20.
aucubæfolia, 12.
aurea, 20.
aurea-pendula, 20.
Biltmoreana, 10.
Bungeana, 2, 3.
caroliniana, 15.
chinensis, 8.
crispa, 20.
cucullata, 20.
cuspidata, 7.
diversifolia, 20.
elegantissima, 20.
epiptera, 9.
erosa, 20.
excelsior, 20.
floribunda, 1.
glauca, 9.
globosa, 20.
heterophylla, 20.
iodocarpa, 9.
jaspidea, 20.
juglandifolia, 1, 9.
laciniata, 20.
lanceolata, 11.
latifolia, 1.
lentiscifolia, 23.
longicuspis, 4.
lutea, 20.
mandschurica, 19.
Mariesii, 5.
monophylla, 20.
nana, 20.
nigra, 18, 19.
novæ-angliæ, 9.
obovata, 3.
oregona, 14.
Ornus, 1.
oxycarpa, 22.
oxyphylla, 22.
parvifolia, 2, 23.
pendula, 20, 23.
pennsylvanica, 11, 12.
pistaciæfolia, 13.
platycarpa, 15.
polemoniifolia, 20.
potamophila, 24.
pubescens, 12.
quadrangulata, 17.
Regelii, 24.
rhynchophylla, 8.
rotundifolia, 1, 23.
rufa, 20.
sambucifolia, 18.
sambucina, 4.
scolopendrifolia, 20.
serratifolia, 6.
Sieboldiana, 4.
simplicifolia, 20.
sogdiana, 21 and suppl. list.
Spaethiana, 6.
syriaca, 21.
tamariscifolia, 22, 23.
Theophrastii, 1 and suppl.
Toumeyi, 13.
triptera, 15.
turkestanica, 21.
velutina, 13.
viridis, 11.

A. *Fls. in terminal panicles on leafy shoots, perfect or polygamous, with or after the lvs.* (*Ornus.*)

B. *Corolla present, divided nearly to the base; stamens with long filaments.*

C. *Petioles not conspicuously enlarged at the base.*

D. *Lowest pair of lfts. not much smaller than the others.*

E. *Lfts. stalked.*

1. **Órnus,** Linn. (*Órnus europæa*, Pers. *F. floribúnda*, Hort., not Wall.). Small tree, becoming 25 ft.: winter-buds gray or brownish tomentulose: lfts. generally 7, stalked, oblong-ovate or ovate, irregularly serrate, rufously pubescent on the midrib beneath, 2–3½ in. long: fls. whitish, fragrant, in dense, terminal panicles 3–5 in. long: fr. erect, narrow-oblong, truncate or emarginate at the apex, about 1 in. long. May, June. S. Eu., W. Asia. Gn. 22, p. 117; 34, p. 78; 48, p. 286; 31, pp. 354, 355. F.E. 22:61. G. 18:541. G.M. 54:860. H.W. 3:60, p. 120. Var. **juglandifòlia,** Tenore (var. *latifòlia*, Dipp. *F. rotundifólia*, Hort.). Lfts. ovate or broadly ovate-oblong. Var. **rotundifòlia,** Tenore (*F. rotundifòlia*, Lam.). Low tree: lfts. roundish-elliptic to roundish-obovate. Var. **angustifòlia,** Tenore (*F. Theophrástii*, Hort., partly). Lfts. lanceolate.

2. **Bungeàna,** DC. (*F. parvifòlia,* Lingelsh. *F. Bungeàna* var. *parvifòlia,* Wenzig). Fig. 1574. Small tree, to 15 ft., or shrub: winter-buds nearly black: lfts. generally 5, stalked, ovate, obovate or roundish, obtuse to short-acuminate, serrate, glabrous, 1–1½ in. long: panicles to 2½ in. long, many-fld.; calyx with narrow acute lobes; filaments longer than the linear petals: fr. narrow-oblong, obtuse or emarginate. May. China. G.F. 7:5 (adapted in Fig. 1574).

EE. *Lfts. sessile.*

3. **obovàta,** Blume (*F. Bungeàna* var. *obovàta,* Lingelsh.). Tree: petioles often slightly winged; lfts. 5–7, oval or obovate, short-acuminate to obtusish, cuneate at the base, crenate-serrate, dull green above and slightly pubescent on the veins, grayish green below and pubescent toward the base of the veins, 2–4 in long: infl. small; petals linear, longer than the stamens: fr. with narrow-oblong obtuse wing. Japan.

DD. *Lowest pair of lfts. much smaller than the others; lfts. long-acuminate.*

4. **longicúspis,** Sieb. & Zucc. Slender tree, to 30 ft., with rufously pubescent winter-buds: lfts. 5–7, stalked, oblong-lanceolate, long-acuminate, obtusely serrate, almost glabrous, 2–4 in. long: fls. in rather slender, narrow panicles, to 4 in. long; petals linear-oblong, about as long as stamens: fr. oblanceolate, obtuse. May. Japan. S.I.F. 1:81. Var. **Sieboldiàna,** Lingelsh. (*F. Sieboldiàna,* Blume). Lfts. oval to oblong-ovate, short-stalked, usually pubescent below along the midrib. Japan, Korea. Var. **sambúcina,** Lingelsh. (*F. Sieboldiàna* var. *sambúcina,* Blume). Lfts. sessile.

5. **Mariésii,** Hook. f. Shrub or small tree: winter-buds grayish black: petiole minutely glandular-pubescent; lfts. 5–7, nearly sessile, close, touching each other, ovate to ovate-lanceolate, acute or acuminate, entire or finely crenate-serrate, yellowish green below and glandular-puberulous on the midrib toward the base, otherwise glabrous, 1½–3 in. long: panicle upright, 5 in. long; petals linear-spatulate about as long as stamens. Cent. China. B.M. 6678.—Handsome and free-flowering; blooms even as a small shrub.

CC. *Petioles distinctly enlarged at the base; lfts. sessile, the lowest pair smaller.*

6. **Spaethiàna,** Lingelsh. (*F. serratifòlia,* Hort., partly). Tree: young branchlets glabrous: winter-buds dark brown: lvs. 6–12 in. long; petiole grooved, reddish brown at the enlarged base, glabrous; lfts. 5–9, oblong to oblong-obovate, deeply crenate-serrate, dark green above, lighter green below and glabrous except along the midrib toward the base, 3–7 in. long: fls. and frs. unknown. Origin unknown.—Handsome tree with large lvs.

BB. *Corolla with a short tube or wanting.*

C. *The corolla with short tube; anthers almost sessile.*

7. **cuspidàta,** Torr. Shrub or small tree, to 20 ft., with dark, reddish brown buds: lfts. usually 7, slender-stalked, lanceolate or oblong-lanceolate, acuminate, coarsely serrate, almost glabrous, 1½–2 in. long: fls. fragrant, in 3–4-in. long panicles: fr. spatulate-oblong. April. Texas to Ariz. and New Mex. S.S. 6:260.—Handsome flowering tree for temperate regions.

CC. *The corolla wanting, or occasionally present; calyx often irregularly toothed.* (*Ornaster.*)

8. **chinénsis,** Roxbg. Tree, to 40 ft.: branchlets glabrous: winter-buds brownish black, conspicuous with a rufous woolly tomentum when opening: lvs. 5–8 in. long; petiole enlarged at the base, nearly glabrous; lfts. 5–7, short-stalked, elliptic to elliptic-oblong or ovate-oblong, acuminate, cuneate at the base, serrate, dark green above, light green below and hairy along the lower part of the midrib, 2–5 in. long: pistillate panicle 3–6 in. long: fr. oblanceolate, obtuse or emarginate at the apex, 1½ in. long and ¼in. broad. China. May. Var. **rhynchophýlla,** Hemsl. (*F. rhynchophýlla,* Hance). Lfts. entire or irregularly crenate-serrate, on slenderer stalks. Cent. and W. China. G.F. 6:485.

AA. *Fls. from leafless axillary buds, before the lvs.; without corolla; filaments usually shorter than anthers.*

B. *The fls. diœcious, with the calyx persistent on the fr.; anthers linear or linear-oblong: lfts. generally 5–7: buds brown.* (*Leptalix.*)

C. *Lvs. always pinnate.*

D. *Fr. oblanceolate or lanceolate; its body terete.*

E. *Lfts. stalked.*

F. *Under side of lfts. glaucous: wing of the fr. not decurrent.*

9. **americàna,** Linn. (*F. nòvæ-ángliæ,* Mill. *F. álba,* Marsh.). WHITE ASH. Fig. 1575. Tall tree, to 120 ft.: branchlets and petioles glabrous: lfts. generally 7, stalked, ovate to ovate-lanceolate, entire or denticulate, dark green above, glaucous beneath, 3–5 in. long: fr. linear-oblong, with terete body, the wing not decurrent, 1½ in. long. From Canada to Fla., west to Minn. and Texas. S.S. 6:268. Em. 377. G.F. 7:405. F.E. 23:427.—Very variable. Var. **acuminàta,** Wesm. (*F. acuminàta,* Lam. *F. epíptera,* Michx. *F. americàna* var. *glaùca,* Hort.). Lfts. dark green and shining above, very glaucous and almost glabrous beneath, usually entire. Var. **juglandifòlia,** Rehd. (*F. juglandifòlia,* Lam.). Lfts. less shining above, usually broader, more or less pubescent beneath, serrate at least above the middle. This is the northern form, while the former is more common in the southern states. Var. **iodocárpa,** Fern. Frs. conspicuous by their reddish purple color. Var. **álbo-marginàta,** Hort. Lfts. edged white.

1575. Fruit or key of Fraxinus americana. (Natural size)

10. **Biltmoreàna,** Beadle. Tree, to 50 ft.: branchlets and petioles pubescent: lfts. 7–9, ovate-oblong to lanceolate, often falcate, acuminate, rounded or broadly cuneate at the base, entire or obscurely toothed, dark green and glabrous above, glaucous below and pubescent, particularly on the veins, 3–6 in. long: panicles pubescent: fr. linear-oblong, with terete body, the wing not decurrent, emarginate at the apex, 1½–1¾ in. long. May. Pa. to Ga., west to Ala., Mo. and Ill. S.S. 14:716.

FF. *Under side of lfts. green or grayish green: wing of the fr. decurrent, hence body margined.*

11. **lanceolàta,** Borkh. (*F. víridis,* Michx., in part. *F. pennsylvánica* var. *lanceolàta,* Sarg.). GREEN ASH. Tree, to 60 ft: branchlets and petioles glabrous: lfts. 5–9, stalked, ovate to oblong-lanceolate, irregularly serrate, green on both sides, almost glabrous, 2–5 in. long: fr. oblanceolate, with decurrent wing, hence body margined, about 1½ in. long. Canada to Fla., west to Rocky Mts. S.S. 6:272.

12. **pennsylvánica,** Marsh. (*F. pubéscens,* Lam.). RED ASH. Tree, to 60 ft.: branchlets and petioles pubescent: lfts. 5–9, stalked, ovate to oblong-lanceolate, acuminate, crenately serrate or entire, pubescent beneath, 3–6 in. long: fr. linear-spatulate, about 2 in. long, with somewhat decurrent wing. Canada to Fla., west to Dakota and Mo. S.S. 6:271.—This species varies considerably in the amount of pubescence and the shape of the lfts., and many forms under different names are grown in European nurseries and gardens. Var. **aucubæfòlia,** Hort., is a form with less pubescent lvs., blotched yellow. There are also variegated forms with the lvs. blotched white or edged white.

EE. *Lfts. sessile or short-stalked: branchlets and petioles pubescent.*

13. **velûtina,** Torr. (*F. pistaciæfòlia,* Torr.). Tree, to 40 ft., with velvety pubescent, rarely glabrous branches: lfts. 5–9, sometimes reduced to 3 or even 1, short-stalked, oblong to lanceolate, usually acuminate, narrowly cuneate at the base, entire or remotely serrate, yellowish green, firm and thick at maturity, pubescent or nearly glabrous beneath, 2–4 in. long: fr. spatulate, with marginless body. Texas to Ariz. and New Mex. S.S. 6:267. G.F. 8:15. —*F. Tòumeyi,* Brit., with narrower more distinctly stalked lfts., is probably only a variety of this species. M.D.G. 1913:556; also S.S. 6:267 represents this variety.—Particularly recommendable for saline and alkaline soil, where but few trees will grow; not hardy N.

1576. Key of Fraxinus nigra. (Natural size.)

14. **oregòna,** Nutt. Tree, to 80 ft.: petioles sometimes glabrous at length; lfts. 7–9, almost sessile or short-stalked, oblong or elliptic, acuminate, entire or obscurely and remotely serrate, light green, 2½–6 in. long, thick and firm at maturity: fr. oblong-obovate, with decurrent wing, about 1½ in. long. Wash. to Calif. S. S. 6:276.

DD. *Fr. elliptic or broadly spatulate, body compressed with the wing all around.*

15. **caroliniàna,** Mill. (*F. platycárpa,* Michx. *F. tríptera,* Nutt.). WATER ASH. Tree, to 40 ft., with pubescent or glabrous branches: lfts. 5–7, stalked, ovate or oblong, acuminate, broadly cuneate or sometimes rounded at the base, serrate, rarely entire, pubescent or glabrous beneath, 2–5 in. long: fr. 1–2 in. long, with pinnately veined wing, often 3-winged. Va. to Fla., west to Ark. and Texas. S.S. 6:274, 275.

CC. *Lvs. usually simple, occasionally 3–5-foliolate: branchlets quadrangular.*

16. **anómala,** Wats. Shrub or tree, to 20 ft.: lfts. broadly ovate or roundish at the apex, rounded, acutish or emarginate, entire or sparingly crenate-serrate, glabrous and dark green above, paler and pubescent below while young, 1½–2 in. long: fls. polygamous: fr. obovate-oblong, rounded or emarginate at the apex, ⅔in. long. Colo., Utah, Nev. and S. Calif. S.S. 6:266.

BB. *The fls. without calyx (only No. 17 has a deciduous minute calyx); anthers cordate, rarely broadly oblong: lfts. generally more than 7, nearly glabrous. (Fraxinaster.)*

C. *Branches 4-angled and usually winged.*

17. **quadrangulàta,** Michx. BLUE ASH. Tree, to 80, rarely 120 ft.: lfts. 7–11, short-stalked, ovate to lanceolate, acuminate, sharply serrate, yellowish green on both sides, 3–5 in. long: fls. perfect: fr. oblong, emarginate, winged all around, 1–2 in. long. From Mich. to Ark. and Tenn. S.S. 6:263.

CC. *Branches terete or nearly so.*

D. *Rachis at the base of lfts. with thick rufous tomentum: fls. diœcious.*

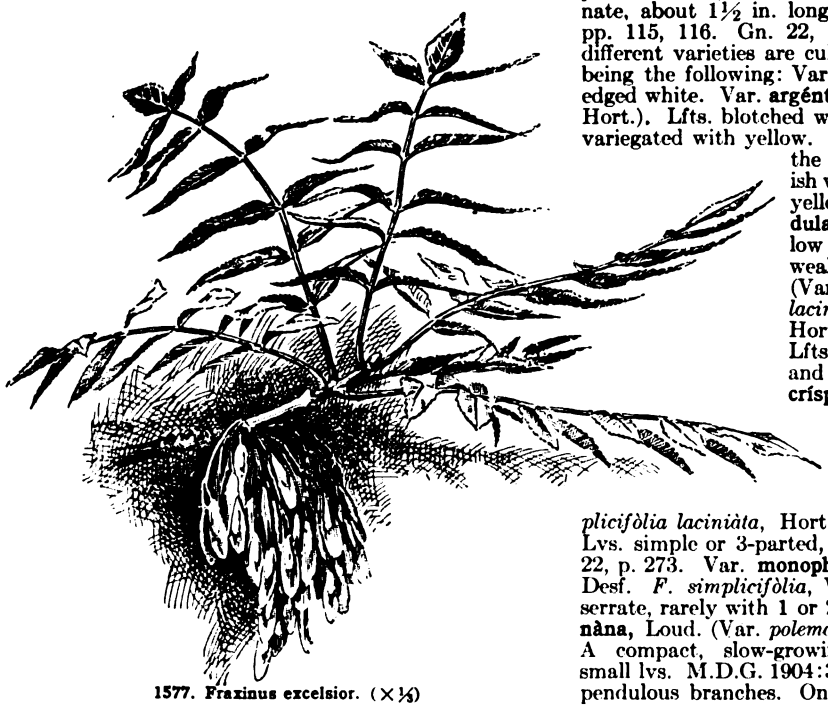
18. **nìgra,** Marsh. (*F. sambucifòlia,* Lam.). BLACK ASH. Fig. 1576. Tree, to 80 ft.: lfts. 9–11, sessile, oblong-lanceolate, rounded at the base, acuminate, sharply serrate, green on both sides, dark above, 3–6 in. long: anthers broadly oblong: fr. narrow-oblong, with decurrent wing. From Canada to Va., west to Mo. S.S. 5:264,265. Em. 382.

19. **mandschùrica,** Rupr. (*F. nìgra,* var. *mandshùrica,* Lingelsh.). Tree, to 100 ft., with obtusely quadrangular branches and dark brown buds: lfts. 9–11, almost sessile, ovate to oblong-lanceolate, sharply serrate, pubescent or hispid on the veins beneath, 3–6 in. long: fr. oblong-lanceolate, 1–1½ in. long. Manchuria, Korea, Saghalin, Japan. S.I.F. 2:62 (as *F. Sieboldiana*).

DD. *Rachis without conspicuous rufous tomentum: fls. perfect or polygamous.*

E. *Buds black.*

20. **excélsior,** Linn. Fig. 1577. Tall tree, to 120 ft.: lfts. 9–13, almost sessile, oblong-ovate or ovate-lanceolate, acute or acuminate, serrate, dark green above, paler beneath, 2–5 in. long: fr. oblong, often emarginate, about 1½ in. long. Eu., W. Asia. H.W. 3:59, pp. 115, 116. Gn. 22, p. 273. F.E. 24:395. Many different varieties are cult., some of the most distinct being the following: Var. **álbo-marginàta,** Hort. Lfts. edged white. Var. **argéntea,** Loud. (var. *álbo-variegàta,* Hort.). Lfts. blotched white. Var. **lûtea,** Loud. Lvs. variegated with yellow. Var. **jaspídea,** Desf. Bark of the young branches striped pinkish white. Var. **aûrea,** Pers. With yellow branches. Var. **aûrea-péndula,** Loud. With pendulous yellow branches, but a somewhat weak grower. Var. **eròsa,** Willd. (Var. *asplenifòlia,* Kirchn. Var. *laciniàta,* Hort. Var. *elegantíssima,* Hort. Var. *scolopendrifòlia,* Hort.). Lfts. very narrow, incisely serrate and often almost linear. Var. **crìspa,** Willd. (Var. *atròvirens,* Var. *cucullàta,* Hort.), with very dark green curled and twisted lvs.; of slow growth. Var. **diversifòlia,** Ait. (*F. heterophýlla,* Vahl. *F. simplicifòlia laciniàta,* Hort. *F. rùfa,* Hort., not Bosc). Lvs. simple or 3-parted, usually incisely dentate. Gn. 22, p. 273. Var. **monophýlla,** Kuntze (*F. monophýlla,* Desf. *F. simplicifòlia,* Willd.). Lvs. simple, ovate, serrate, rarely with 1 or 2 small lfts. at the base. Var. **nàna,** Loud. (Var. *polemoniifòlia,* Var. *globòsa,* Hort.). A compact, slow-growing, dwarf form with very small lvs. M.D.G. 1904:380. Var. **péndula,** Ait. With pendulous branches. One of the best pendulous trees



1577. Fraxinus excelsior. (×⅛)

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for forming arbors and shady seats. Gn. 39, p, 451; 68, p. 400.

EE. *Buds brown.*

F. *Lfts. sessile or nearly so.*

G. *Number of lfts. 3–5, rarely 7.*

21. **syríaca,** Boiss. (*F. sogdiàna*, Dipp., not Bunge. *F. turkestànica*, Carr.). In cult. usually small tree, the branches with short internodes and lvs. therefore crowded, often in whorls of 3: lfts. lanceolate, acuminate, cuneate at the base, serrate, bright green and quite glabrous on both sides, 1½–2½ in. long: panicles 1½ in. long: fr. usually obovate-oblong, obtuse. Syria to Kurdistan.

GG. *Number of lfts. 7–13.*

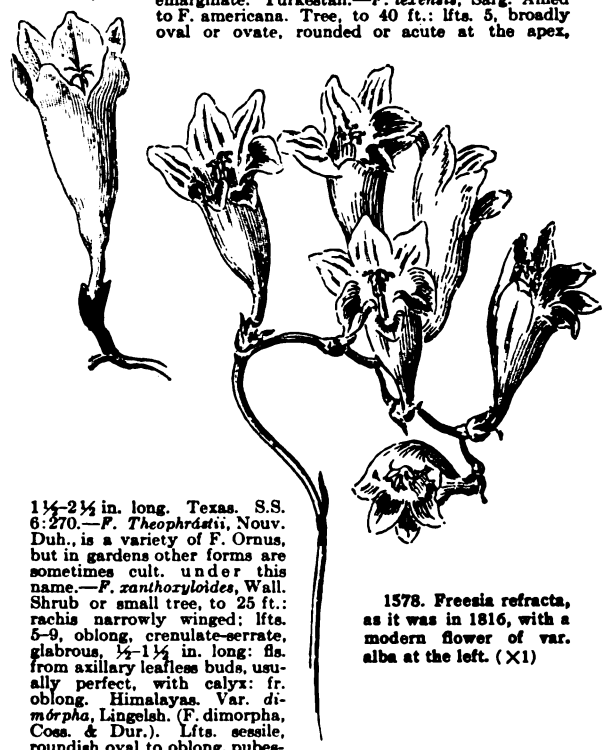
22. **oxycárpa,** Willd. (*F. oxyphýlla*, Bieb. *F. tamariscifòlia*, Hort., partly). Tree: lfts. 7–11, ovate-oblong to oblong-lanceolate, acuminate, cuneate at the base, sharply serrate, light green on both sides and glabrous except along the midrib below, 1½–3 in. long: fr. obovate-oblong, acute or obtusish, narrowed at the base. May. S. Eu. to Persia.

23. **rotundifòlia,** Mill. (*F. parvifòlia*, Lam. *F. lentiscifòlia*, Desf. *F. tamariscifòlia* Hort., partly). Shrub or small tree, to 15 ft., with slender, often purplish branches: lfts. 7–13, sessile, broadly oval to elliptic, rarely obovate, acute, or rounded at the apex, serrate, ½–1½ in. long: fr. oblong, obtuse or acute. W. Asia, S. Eu. Var. **péndula,** Rehd. (*F. parvifòlia* var. *péndula*, Dipp.), with pendulous branches, forming a graceful small weeping tree.

FF. *Lfts. distinctly stalked; stalk ⅛–¾in. long.*

24. **potamóphila,** Herd. (*F. Règelii*, Dipp.). Small tree, to 30 ft., with rather stout, upright branches: lfts. 7–13, stalked, rhombic-ovate or ovate-lanceolate, serrate, acute or acuminate, glabrous or sparingly pubescent on the midrib below, 1–2½ in. long: fr. oblanceolate-oblong, with decurrent wing, acute, 1 in. long. Turkestan, Songaria.—Handsome tree with round head and dense small foliage.

F. angustifòlia, Vahl. Closely related to F. oxycarpa. Lfts. 7–13, elliptic-lanceolate to lanceolate, serrate, ½–1½ in. long: fr. obtuse at the base. S. Eu., N. Afr., W. Asia. Var. *austràlis*, Schneid. (F. australis, Gay). Lfts. below and rachis hairy.—*F. argéntea*, Loisel., is a variety of F. Ornus, not in cult., but in gardens often other ashes, especially variegated forms, are cult. under this name.—*F. austràlis*, Gay=F. angustifolia var. australis.—*F. Berlandieriàna*, DC. Allied to F. lanceolata. Tree, to 70 ft.: lfts. 3–5, ovate or obovate, serrate, downy along the veins beneath, to 4 in. long. Texas to Mex. S.S. 6:273.—*F. bracteàta*, Hemsl.=F. Griffithii.—*F. coriàcea*, Wats. Allied to F. velutina. Tree, to 30 ft.: lfts. 5, subcoriaceous, ovate to oblong, acute, broadly cuneate or rounded at the base, glabrous or pubescent below. S. Calif. to Utah, Ariz., Nev. S.S. 14:713.—*F. dimórpha*, Coss. & Dur.=F. xanthoxyloides var. dimorpha.—*F. dipétala*, Hook. & Arn. Allied to F. cuspidata. Shrub: lfts. 5–7, elliptic or ovate, serrate or entire, ½–2 in. long: fls. with 2 obovate petals. Calif., Mex. S.S. 6:261. Tender.—*F. floribùnda*, Wall. Allied to F. longicuspis. Tree, to 40 ft.: lfts. 5–7, ovate-lanceolate, serrate, reticulate beneath, 2–4 in. long: panicles large, to 10 in. long; petals oblong. Himalayas. Tender.—*F. floridàna*, Sarg.=F. pauciflora.—*F. Greggii*, Gray. Allied to F. cuspidata. Small tree: lfts. 3–7, oblong-obovate, crenately serrate, or entire, ½–1 in. long: fr. linear-oblong, emarginate. S.S. 6:262. G.F. 2:451.—*F. Griffithii*, Clarke (F. bracteata, Hemsl.). Allied to F. Mariesii. Tree, to 40 ft.: lfts. 5–7, subcoriaceous, elliptic to ovate-lanceolate, lustrous above, bright green below and pubescent on the veins, 2–4 in. long: infl. 6–8 in. high, with persistent lanceolate bracts; petals 4: fr. spatulate. Cent. China, Himalayas, Java.—*F. holotricha*, Koehne. Allied to F. potamophila. Tree: lfts. 9–13, ovate-lanceolate or lanceolate, pubescent on both sides, 1½–3 in. long: fls. in 10-fld. racemes; ovary pubescent. Origin unknown.—*F. hybrida*, Lingelsh.=F. pauciflora.—*F. pauciflòra*, Nutt. (F. floridana, Sarg. F. hybrida, Lingelsh.). Allied to F. caroliniana. Tree, to 40 ft.: lfts. 3–5, oblong, acuminate, cuneate at the base, tomentose below: fr. oblong-lanceolate, rounded or emarginate at the apex. Ga. to Fla. S.S. 14:717.—*F. Parìana*, Lingelsh. Allied to P. longicuspis. Tree, to 40 ft.: lfts. 7–9, sessile, ovate, crenulate, 4–7 in. long: panicle large and dense: fr. 1–1¼ in. long, ⅛in. broad. Cent. China, Himalayas.—*F. platypoda*, Oliver. Allied to F. americana. Tree: petioles enlarged and winged at the base; lfts. 5–7, ovate-lanceolate, finely serrate, hairy along the midrib below, 2–4 in.: fr. narrow-oblong, acute. Cent. China. H.I. 20:1929.—*F. profùnda*, Bush. Allied to F. pennsylvanica. Lfts. 7–9, oblong-lanceolate, acuminate, entire, 3–6 in. long, tomentose beneath: fr. 2–2½ in., with decurrent wing. Ind., Ark., to Fla. S.S. 14:714–5.—*F. pubinérvis*, Blume. Allied to F. longicuspis. Lfts. usually 9, ovate to oblong-ovate, serrate with incurved teeth, pubescent on the veins below, 3–5 in. long: fr. oblanceolate. Japan.—*F. raibocárpa*, Regel. Shrub: lfts. 3–7, oblong or oblong-obovate, usually entire, obtuse, 1–2 in. long: fr. strongly falcate with obovate not decurrent wing. Turkestan, Bukhar.—*F. retùsa*, Champ. Allied to F. Mariesii. Tree: lfts. about 5, ovate to ovate-lanceolate, glabrous, reticulate, 2–3 in. long. Hongkong. Var. *Henryàna*, Oliver. Shrub or tree, to 35 ft.: lfts. slender-stalked, oblong to lanceolate, serrulate, 3–5 in. long: panicle dense, 4–6 in. long: fr. ¾–1 in. long, emarginate. Cent. China. H.I. 20:1930. Only the variety is in cult.—*F. sogdiàna*, Bunge. Allied to F. potamophila. Lfts. 7–11, ovate-lanceolate, bright green: fr. 1¼ in. long, obtuse or emarginate. Turkestan.—*F. texénsis*, Sarg. Allied to F. americana. Tree, to 40 ft.: lfts. 5, broadly oval or ovate, rounded or acute at the apex,



1578. Freesia refracta, as it was in 1816, with a modern flower of var. alba at the left. (×1)

1¼–2½ in. long. Texas. S.S. 6:270.—*F. Theophrástii*, Nouv. Duh., is a variety of F. Ornus, but in gardens other forms are sometimes cult. under this name.—*F. xanthoxyloides*, Wall. Shrub or small tree, to 25 ft.: rachis narrowly winged: lfts. 5–9, oblong, crenulate-serrate, glabrous, ½–1½ in. long: fls. from axillary leafless buds, usually perfect, with calyx: fr. oblong. Himalayas. Var. *dimórpha*, Lingelsh. (F. dimorpha, Coss. & Dur.). Lfts. sessile, roundish oval to oblong, pubescent on the midrib below. N. Afr. Var. *dumòsa*, Lingelsh. (F. dimorpha var. dumosa, Carr.). A low shrubby form of the preceding variety, with small lfts.—This species belongs to the section Sciadanthus, having perfect apetalous fls. with calyx.

ALFRED REHDER.

FREÈSIA (name unexplained, perhaps personal). *Iridàceæ*. Popular "bulbs" for fall planting and winter blooming, and next to the Chinese narcissus, which may be grown in water, they flourish in home windows with less care than most other bulbs; they are also much-prized florists' plants; easily grown, attractive, and fragrant.

Cormous plants, with plane narrow lvs. at the base and somewhat on the sts., and showy fls. in small clusters at the top of the slender st.: perianth tubular and funnel-shaped, the segms. more or less unequal; stamens 3, inserted in the tube, the anthers linear; ovary ovoid or oblong, 3-celled, with crowded ovules, the style filiform and the branches 2-fid (Tritonia, closely allied, has simple style-branches): fr. a loculicidal 3-valved caps., bearing turgid seeds.—S. Afr., probably 2 or 3 original species, but the specific limits difficult of determination.

Freesias have well-shaped tubular flowers, white or pale yellow. The five to seven flowers are upright and attached along a jointed axis which is suddenly bent back almost at right angles to the vertical peduncle. The popularity of freesias is a growth of the last quarter century or more, although they have been in cultivation since 1816 or earlier. Conservative botanists now suppose that the usual garden freesias are all originally of one stock, which species should be called *F.*

refracta. Extremes of variation in form are shown in Figs. 1578 and 1579, from the long and slender tube of var. *alba* to the short and broader tube of var. *Leichtlinii*. One of the earliest pictures of the plant is that in the "Botanical Register" for 1816 (Plate 135, as *Tritonia refracta*), a part of which is reproduced in Fig. 1578 to show the great irregularity of the corolla-lobes at that early period, and the straggling habit of the flowers, some pointing down and others up. The garden evolution of the freesias has proceeded along two lines. The greatest effort has been expended to produce a pure white flower, and in the best strains the white color is mostly associated with a long and slender tube. The ideal of a yellow flower is less popular, and is mostly associated with the shorter and broader

1579. Freesia refracta var. Leichtlinii. (×⅓)

tube. In both cases the forms with straggling inflorescence and irregular corolla-lobes have been suppressed. One may readily see how strongly two-lipped and gaping were the flowers of 1816, and how much the tube was bulged on one side. Any tendencies toward such forms in modern bulbs are signs of undesirable characters. In pedigree plants the lobes are rounded and the flowers symmetrical.

These plants are much forced by florists, chiefly for cut-flowers at Christmas. If cut when only two flowers are out, the others will open. They may be had in flower from Christmas until June by successional plantings from August to February. For the best results the largest and highest-priced bulbs should be planted as early as August. Under good care, the bloom may be secured in ten to twelve weeks after the bulbs are planted; it is not necessary that the bulbs be kept cool or stored for a time after potting, as is the case with hyacinths and tulips, for they root quickly and start rapidly into growth. For holiday bloom, the bulbs are planted in October. One of the strong points of freesias is that planting may be delayed longer than with many other bulbs. Bottoms may be dried off gradually in the pots and then be shaken out and kept dry during summer. Repot; the larger bulbs will bloom, but will not give so good results as medium-sized imported bulbs not previously forced. When the plants are growing, keep them cool and moist. Provide good drainage, and let the potting earth contain a little sand and more or less fibrous material. Usually several bulbs are planted together in pots or boxes (about six bulbs in a 5-inch pot). Offsets are freely produced and these may be used for propagation; or seeds may be employed, giving blooming plants in two or three years, or sometimes the recent hybrid forms are said to give bloom in six to seven months from seeding.

refrácta, Klatt. Fig. 1578. Weakly erect, 1–1½ ft., from an ovoid reticulated corm, the st. more or less distantly branched and bearing a few reduced lvs: the basal lvs. about 6, linear, firm, about 6 in. long: fls. in loose secund spikes on a flexuose rachis, the spathe-valves oblong-lanceolate and acute and not covering the ovary; perianth greenish yellow or bright yellow, to 1½ in. long, the tube abruptly constricted below the middle, the limb distinctly labiate and the segms. unequal. B.R. 135 (as *Tritonia refracta*).—The original type is probably no longer in cult. Var. **álba,** Baker (*F. álba*, Hort.). Lvs. broader: infl. less branched; spathe-valves broader, toothed, covering the ovary; fls. large, clear white, with a gradually narrowing tube, the perianth-limb not bilabiate (or only indistinctly so), the segms. obtuse and nearly equal. G. 5:97; 8:575; 27:88. G.M. 50:927. Gn.W. 15:10. J.H. III. 43:272. The common garden form, much prized. *F. virginalis grandiflora* is a seedling of this, the fls. being much larger, ground-color white and less yellow in throat. G. 31:215. Var. **odoràta,** Baker (*F. odoràta*, Klatt). Lvs. broader than in the type, less rigid, and infl. less branched and fls. fewer: spathe-valves broader and more obtuse, toothed at the apex, covering the ovary; fls. bright yellow, the tube abruptly constricted, the limb not distinctly bilabiate and the segms. obtuse and nearly equal. L.B.C. 19:1820 (as *Tritonia odorata*). Var. **Leíchtlinii,** Hort. (*F. Leíchtlinii*, Klatt), (Fig. 1579), differs in its shorter abruptly constricted tube and large pale yellow fls.; by many considered to be a distinct species.

Ármstrongii, W. Wats. Differs from *F. refracta* in the color of the fls. and absence of purple from the lf.-bases: 16–20 in.: tube white with orange at base, the segms. markedly bordered with rose-purple: about one month later in blooming then *F. refracta alba*. Named for W. Armstrong, of S. Afr. Gn. 59, p. 374. G.M. 48:833.

hýbrida, Hort. Here belong many hybrid forms, some of them known as the "colored freesias," as: *F. Chápmanii*, a cross of the typical *F. refracta* (*F. aurea*, Hort.), with var. *alba*, producing a soft yellow flushed with deeper yellow and with an orange blotch (Gn. 71, p. 165. G.M. 50:164. G. 31:175); *F. Tubérgenii*, being a cross of *F. refracta alba*, and *F. Armstrongii* (G.W. 13, p. 199. G. 28:215. Gn. 69, p. 184. J.H. III. 52:299); *F. kewénsis*, hybrid probably between *F. Armstrongii* and *F. Leichtlinii*; *F. Màidenii*, being *F. refracta alba* × *F. Armstrongii*; *F. Ragionièri*, a race resulting from the crossing of *F. refracta*, *F. Leichtlinii* and their hybrids with *F. Armstrongii*, described as producing scented fls. tinted in shades of pink, rose, purple, blue, brown, orange, and spotted and veined.

L. H. B.†

FREMÓNTIA (after John Charles Fremont, distinguished western explorer, who discovered it in 1846). Syn. *Fremontodéndron*. *Sterculiàceæ*. Ornamental woody plant, grown chiefly for its showy yellow flowers.

Deciduous shrub or small tree with stellate pubescence: lvs. alternate, slender-petioled, palmately lobed: fls. solitary on short, lateral branchlets, apetalous; calyx large, deeply 5-parted, with 3 small bracts at the base; stamens 5, connate toward the base into a tube; ovary superior, inclosed by the staminal tube; style filiform: fr. a 5-celled, hirsute, dehiscent caps. with

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many seeds.—One species in Calif., allied to the Mexican Cheiranthodendron. Its bark is sometimes used as a substitute for that of the slippery elm and the plant is therefore locally known under this name.

This is a beautiful free-flowering shrub, with rather small, palmately lobed leaves and large yellow flowers appearing in great profusion in June. It is not hardy North, and in cooler regions it should have a sunny and sheltered position, preferably against a wall of southern aspect; it prefers well-drained, rather dry soil, and dislikes, especially during the winter, an excess of moisture. Propagation is by seeds or by greenwood cuttings under glass in summer.

californica, Torr. (*Fremontodéndron californicum*, Coville). To 20 ft.: lvs. generally roundish ovate, cordate or rounded at the base, obtuse, 3–5-lobed or almost entire, whitish or ferrugineous pubescent beneath, ¾–1½ in. long: calyx 1½–3 in. across, deep yellow, with stellate hairs outside, villous at the base within; lobes orbicular: caps. densely beset with hispid hairs, 1 in. long. S.S. 1:23. B.M. 5591. Gn. 3, p. 55; 22, p. 115; 29:8; 33, p. 566. G. 5:397; 32:457. G.M. 50:29. F.S. 22:2349. R.H. 1867:90. I.H. 13:496. B.H. 17:13. ALFRED REHDER.

FREYCINÈTIA (Chas. Louis de Freycinet, 1779–1842, French navigator). *Pandanàceæ*. Climbing or straggling shrubs sometimes seen under glass and perhaps planted far S., but apparently not in the American trade. The sts. are often prolonged, rooting: lvs. sheathing at base, the free part long and narrow, carinate, serrate or entire: fls. dicœcious, in terminal fascicled spadices surrounded by fleshy leafy often colored bracts; males consisting of several stamens with short filaments; females of many 1-celled many-ovuled densely packed ovaries: fr. an oblong mass of fleshy or hard drupes.—Species above 50, islands of the Pacific, Austral., New Zeal. *F. Bánksii*, Cunn., is a tall climber, sometimes attaining the tops of high trees, with many stout branches, the arching lvs. to 3 ft. long and most abundant toward the ends of the branches: fl.-bracts numerous and leafy, the inner ones with thick succulent bases, sweet, and often eaten in New Zeal., where the plant is native: fr. rather fleshy, brown at maturity, ½in. long, edible. B.M. 6028. *F. Cumingiàna*, Gaud., of uncertain nativity, is more slender, lvs. not arching and divaricate. The freycinetias are little grown indoors as they require much room. They may be used as pillar plants. Prop. by offsets. L. H. B.

FRINGE-TREE: *Chionanthus virginica.*

FRITILLÀRIA (Latin *fritillus*, commonly understood to be a checker-board, but may have meant dice-box). *Liliàceæ*. FRITILLARY. This group includes the crown imperial and the fritillaries, hardy bulbous plants, mostly low-growing and spring-blooming, with drooping or nodding flowers which are often checkered or tessellated with dark purple and green, but some also with brighter colors.

Various leafy-stemmed simple herbs, the st.-lvs. narrow, sessile, alternate or whorled, the bulb mostly of few fleshy scales: perianth deciduous, mostly bell-shaped or sometimes bowl-shaped, the segms. nearly or quite equal, oblong or ovate, all or the inner ones with a nectar-bearing cavity or area at the base; stamens 6, with slender filaments and linear or oblong anthers; ovary 3-celled, nearly or quite sessile: fr. an ovoid or subglobose loculicidal winged or angled caps., with numerous seeds.—Species perhaps 70, widely distributed in the north temperate zone. Fritillaries resemble lilies in having drooping or nodding fls. but their anthers are fixed at the base, while those of the lilies are fastened on the back but are free to swing about. Lilies have funnel-shaped fls., while fritillaries and tulips have bell-shaped fls., and tulip fls. are erect. Nearly all the Old World fritillaries resemble tulips in having coated bulbs, while the American fritillaries resemble lilies in having scaly bulbs.

The most popular kinds are the checkered lily (*F. meleagris*) and crown imperial (*F. Imperialis*). Figs. 1582, 1583. These are hardy, easy to cultivate, and variable. The crown imperial is one of the most characteristic plants of old-fashioned gardens, but it has been banished from many modern gardens because of its strong fetid odor. It is the most robust species, and until lately was supposed to be the only one with its flowers in umbels, all the others being solitary or in racemes. It rejoices the children early in every spring by its pearly drops of nectar, which seem never to fall. *F. meleagris*, the most popular of the purple kinds, is the common snake's-head or checkered lily, so called from the tessellation of purple and green, which is prettiest when as sharply and regularly defined as possible. This plant grows wild in moist English meadows, and can be naturalized in large quantities in such situations. Other ancient inhabitants of European gardens are *F. latifolia*, *F. lutea* and *F. persica*. Other kinds are apparently less known in gardens. As a rule, the kinds that are chiefly purple or green, or mixtures of both colors, are dull, unattractive and curious compared with the few kinds that have brilliant yellow or red. Of the duller and purple kinds, two of the choicest, next to *F. meleagris*, are *F. tulipifolia* (which is flamed like a tulip and never checkered) and *F. camtschatcensis*, great masses of which in Alaska make one of the "summer sights" remembered by the tourists. The white in fritillaries is perhaps always more or less greenish, and the white color in *F. meleagris* is as good as in any species. A most brilliant species is *F. recurva*, which is also difficult of culture. Next in brilliancy come such species as *F. lutea*, *F. aurea*, *F. Moggridgei* and *F. pudica*, all highly individual and all yellow, some checkered, others not.

The culture of fritillaries is rather various, as some species are capable of being naturalized, some cultivated in borders, some in rockeries and others in pots. The crown imperial, being exceptionally vigorous, requires deep planting, rich soil and much room. The earth should be trenched. Well-rotted manure may be worked into the soil 6 inches below the bulbs and the bulbs set on a level 6 inches from the surface of the ground. If possible it should be shaded from the midday sun, as southern exposures are said to make the flowers smaller and shorter-lived. In border cultivation of fritillaries the essential peculiarities are a sheltered shady site, early fall planting, division every two or three years, and, as a rule, a warm, deep, sandy loam, which is not too cold or too retentive of moisture. Bulbs of the taller kinds may be planted 3 to 4 inches deep; bulbs of the dwarf kinds may be set at half that depth. As all fritillaries increase rapidly by offsets, it is desirable to lift and divide the plants at least every three years, or the small bulbs will rob the big ones. For the same reason, fritillaries are rarely propagated by seeds. The dwarf and rare sorts require more care and some leaf-mold in their soil, and some kinds require an evergreen carpet through which they may spring, as *Sedum hispanicum* or its var. *glaucum*.

Our native fritillaries, which include the bright-flowered *F. recurva* and *F. pudica*, are confined to the Pacific coast. Of these Carl Purdy makes two cultural groups, based on the character of bulb, the kind of soil and the conditions of shade. The first group contains *F. biflora*, *F. liliacea*, *F. pluriflora* and *F. Purdyi;* the second *F. atropurpurea*, *F. coccinea*, *F. lanceolata*, *F. parviflora*, *F. pudica* and *F. recurva*. The former grow in the sun in open fields in heavy clay soils; the latter in shady woods in well-drained soils, but *F. pudica* does not need so much shade as the others of its group, and must have sandy loam and slight shelter. The bulbs of the first group are composed of thick, heavy scales

attached to a thin rhizomatous base, and the stems are 4 to 12 inches high and very leafy at the base; in the second group the bulbs are of one piece, and low-conical in form, their sides thickly covered with small, round, white rice-like offsets, and the slender stems are 1 to 3 feet high and leafy above the base. For the first group Purdy recommends a rich loam, and a slight shade to draw out the stems and prolong the bloom; for the second group a light, loose soil, rich in mold, a sheltered place and considerable shade. At the best these are not profuse in their bloom.

The key to the various subgenera here given is essentially Baker's in his monograph in Jour. Linn. Soc. 14:251 (1875); it rarely happens that the botanical and horticultural interests agree in using such simple and obvious characters as those of the bulb and style. The nectaries or glands are less useful and reliable, but they help to explain the natural groups in this varied genus.

KEY TO THE SUBGENERA.

	Species.	Subgenera.
A. *Bulbs tunicated (i.e., coated).*		
B. *Style 3-cut.*		
C. *Glands distinct and prominent, equal.*		
D. *Glands long*	1.	EUFRITILLARIA
DD. *Glands wide*	2–14.	MONOCODON
CC. *Glands obscure, equal, long*		NOTHOLIRION
BB. *Style undivided.*		
C. *Glands equal, obscure*	15–17.	AMBLIRION
CC. *Glands unequal, prominent.*		
D. *Glands long*	18.	KOROLKOWIA
DD. *Glands short*		RHINOPETALUM
AA. *Bulbs scaly.*		
B. *Style undivided*	19–21.	THERESIA
BB. *Style 6-cut.*		
C. *Caps. acutely angled.*		
D. *Fls. solitary or racemose*	22–25.	GONIOCARPA
DD. *Fls. in umbels*	26.	PETILIUM
CC. *Caps. obtusely angled*	27–30.	LILIORHIZA

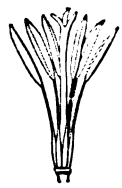
INDEX.

alba, 1.
armena, 16.
atropurpurea, 24.
aurea, 7–9.
biflora, 29.
Burnatii, 3.
camschatcensis, 30.
chitralensis, 26.
coccinea, 25.
contorta, 1.
delphinensis, 3.
Elwesii, 14.
floribunda, 22.
fusco-lutea, 16.
gracilis, 22.
Imperialis, 26.
kamschatcensis, 30.
lanceolata, 22.
latifolia, 7–9.
leucantha, 4.
libanotica, 20.
liliacea, 28.
longipetala, 26.
lutea, 7–9.
meleagris, 1.
meleagroides, 11.
minor, 11, 19.
Moggridgei, 3.
mutica, 22.
oranensis, 13.
pallidiflora, 10.
parviflora, 23.
persica, 19.
pluriflora, 21.
pudica, 17.
Purdyi, 21.
pyrenaica, 12.
Raddeana, 26.
recurva, 27.
ruthenica, 6.
Sewerzowi, 18.
Thunbergii, 4.
tubæformis, 3.
tulipifolia, 15.
verticillata, 4.
Walujewi, 5.
Whittallii, 2.

1. **meleàgris,** Linn. CHECKERED LILY. SNAKE'S-HEAD. Figs. 1580–1582. St. 1 ft. or more high: lvs. 3 or 4, linear or lanceolate, typically 1-fld.: fl. dull red with the inside checkered and spotted with higher color; segms. oblong, narrowed at both ends, about 1½ in. long, the inner ones bearing an oblong or linear cavity; fls. sometimes white or yellowish, or purplish and more or less checkered. England and Norway, through Cent. Eu. to Caucasus. Gn. 32:536; 47, p. 330; 52, p. 243.—The Dutch bulb-growers keep several kinds distinct. The extremes of color-range are (1) a greenish white, (2) a sufficient degree of purple to make the checkering as distinct as possible, and (3) an approach to yellow. Some kinds bear 2–3 fls.; some are double; some fls. spread so widely as to be almost funnel-shaped. Var. **álba,** Hort. White. G. 29:355. Gn.W. 21:221. Var. **contórta,** an old monstrosity, instead of segms. free all the way, and a shouldered base, has the lower third of the perianth united into a funnel-shaped tube. The yellow of some fls. is conjectured to be the result of a cross with *F. lutea* made before Gerarde's time. In England the species flowers toward the end of April. G. 18:182; 35:273. J.H. III. 52:329. Gn.M. 10:117; 12:228. Gn. 61, p. 306 (vars.) G.M. 52:770.

2. **Whíttallii,** Baker. Height 1 ft.: st. 1-fld.: lvs. linear, glaucous: fls. checkered green and brown; nectaries orbicular. Mt. Taurus.

3. **tubæfórmis,** Gren. & Godr. (*F. delphinénsis,* Gren.). St. 6–12 in., often only 1-fld.: lvs. above middle of st. oblanceolate to linear: fls. wine-purple, spotted yellow and somewhat checkered, inodorous; segms. obtuse. Alps.—Distinguished by the glands 3–4 lines long and stigmas very short. Baker gives the same color-range as for *F. meleagris.* The most desirable form is var. **Móggridgei,** Boiss. (*F. Móggridgei,* Hort.), with bright yellow, checkered inside with bright red or reddish brown. This is a dwarfer form from the maritime Alps with wider lvs. (6–9 lines), longer stigmatic cusps, approaching *F. lutea,* and essentially yellow-fld. G.C. II. 13:533. Gn. 18:132. F.M. 1880: 405.—It blooms early. Var. **Burnàtii,** Planch., bright plum-color, checkered greenish yellow: fl. solitary, broadly bell-shaped, smaller, earlier and with smaller glands.



1580. Stamens and pistil of Fritillaria Meleagris.

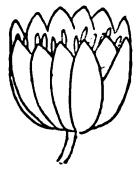
From Flora Danica, showing the 3-cut stigma, an important character in this genus.

4. **verticillàta,** Willd. (*F. leucántha,* Fisch.). Height 1½ ft.: sts. simple, often 1-, sometimes 2–5-fld.: lvs. near the middle of the st., ovate and tapering toward the apex: fls. white or yellow, with small darker spots at the base. Altai Mts. B.M. 3083.—In the type the lvs. are numerous, 20–40: anthers barely half as long as the filaments: style no longer than the ovary, but in var. **Thúnbergii,** Hort. (*F. Thúnbergii,* Miq.), the upper lvs. are often sparse: anthers as long as the filaments; style 1½–2 times as long as the ovary. G.C. II. 13:532. It is doubtful whether the yellow-fld. form is cult.

5. **Walujèwi,** Regel. Probably belongs here, as its linear lvs. have tendrils: st. 1 ft.: fls. silver-white or lead-colored outside and crimson-brown spotted white or yellow inside. Turkestan. Gn. 52:243.

6. **ruthénica,** Wikst. Height 1–2 ft.: st. 1–3-fld.: lvs. 6–20, linear-lanceolate: fls. livid purple, obscurely checkered. Caucasus.

7–9. **lûtea,** Miller, and its allies **F. latifòlia,** Willd., and **F. aûrea,** Schott. These 3 names may be taken as representing the 3 well-marked types of color: *F. lutea* an intermediate form, essentially yellow, but greenish, and with the purple checker-marks duller in color and not so sharply defined and regular. *F. latifolia* representing the extreme of dark purple and green without yellow; *F. aurea,* at the other extreme, being essentially yellow, the checker marks smaller and more sharply defined, and the colors bright. In this sense the pictures may be referred to the types as follows: B.M. 1538 to *F. lutea;* B.M. 853 and 1207 to *F. latifolia;* B.M. 7374, R.H. 1878, p. 287, Gn. 42: 72, J.H. III. 28:357, to *F. aurea. F. latifolia* represents the extreme width of lvs., and *F. aurea* is said to differ in having the lower lvs. often whorled. All these grow ½–1 ft. high. One of the most anciently cult. of all fritillaries is *F. lutea,* which is found promiscuously mingled with the wider-lvd. form, both wild and cult. At present the most popular of the 3 is probably *F. aurea.* The Dutch bulb-growers advertise several varieties of *F. latifolia.* These 3 species are fom S. W. Asia.—*F. lùtea.* St. often 1-fld.: lvs. alternate, linear-lanceolate: fls. yellow, more or less marked or suffused with purple; segms. oblong-lanceolate. *F. latifòlia* (*F. lutea* var. *latifolia*) has



1581. Strange form of doubling in the checkered lily, pictured as early as 1613.

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lanceolate lvs., the upper ones opposite: fls. purple. *F. aurea.* Lvs. 10–12, lower in 3's, linear, somewhat glaucous and fleshy: fls. solitary, bright yellow.

10. **pallidiflòra,** Schrenk. Height 6–15 in.: lvs. many, large and broad, glaucous-blue: fls. 1–6, yellow, handsomely tessellated inside. Siberia. B.M. 6725 (green, with a few dark purple spots). Gt. 6:328. R.H. 1880, p. 215. G.C. II. 19: 573. Gn.W. 23:397.

1582. Common Snake's-Head or Checkered Lily (Fritillaria meleagris).

Faithfully redrawn from Besler's Hortus Eystettensis, published in 1613. (Incorrect as to stamens and some other characters.)

11. **meleagroìdes,** Patrin. (*F. mìnor,* Ledeb.). Height 1–2 ft.: st. very slender, mostly 1-fld.: lvs. 3–6, narrowly linear: fls. dark purple, spotted green; anthers a third the length of the filaments. W. Siberia. B.M. 3280.

12. **pyrenàica,** Linn. Height 1–1½ ft., mostly 1-fld.: lvs. 6–10, linear, glaucous: fls. dark purple, spotted green; anthers two-fifths the length of the filaments. Pyrenees. B.M. 664, not 952 or 1216.

13. **oranénsis,** Baker. Height 1–1½ ft.: lower lvs. lanceolate; upper lvs. linear: fls. dark purple, obscurely checkered green. Mt. Oran. G.C. II. 13:341.

14. **Élwesii,** Boiss. Lvs. 5–6: fls. green, flushed purple on back and tips, not checkered. Lycia. B. M. 6321 (erroneously, as *F. acmopetala*). Gn. 65, p. 307. Gn.W. 21:445.

15. **tulipifòlia,** Bieb. Height 2–8 in.: st. 1-fld.: lvs. 3–4, elliptic, concave, nerveless, 1½–2½ in. long: fls. solitary, inside rusty brown-purple, not checkered, outside dark glaucous-blue, streaked with the same purple. Caucasus. B.M. 5969.—One of the choicest and daintiest kinds. Very distinct. Foliage glaucous blue: fls. resembling a tulip in shape, and with a chalky look outside.

16. **armèna,** Boiss. Height 6–12 in.: st. 1-fld.: lvs. 4–5, lower lanceolate, upper linear: fls. between funnel- and bell-shaped, dark purple, not checkered. Armenia. B.M. 6365. J.H. III. 35:83. Var. **fúsco-lûtea,** Hort., tawny yellow.

17. **pûdica,** Spreng. St. 2–10 in.: lvs. 3–8, lower ones strap-shaped, often opposite (while in *F. tulipifolia* and *F. armena* they are alternate), upper ones linear: fl. usually solitary, pale or dark yellow, rarely purple, never checkered; segms. oblong-spatulate and obtuse, more or less spreading. N. W. Amer. Gn. 13:598; 61, p. 337. R.H. 1895, p. 229. G.C. III. 19:403. J.H. III. 32:295. Mn. 4:49.—The stamens (as in Nos. 14 and 15) are nearly as long as the perianth. "Deep orange-yellow, fragrant."—Van Tubergen.

18. **Sewérzowi,** Regel. Height 1–1½ ft.: lowest lvs. lorate-lanceolate, 1 in. wide, often opposite, upper lvs. lanceolate, 6–7-nerved, 3–4 in. long: pedicels 3–6 lines long; fls. 6–10, green, not checkered, but with a few purple spots outside; filaments purple; anthers green. Turkestan. Gt. 760. B.M. 6371. J.H. III. 30:319. G.C. III. 1:457. Gn. 69, p. 133.

19. **pérsica,** Linn. Robust, 2–3 ft. high: lvs. 40–60, glaucous, linear, 4–6 in. long, 6–9 lines wide: raceme 10–50-fld.; fls. small bell-shaped, slightly odorous, lilac-purple, sometimes chalky outside and lined with purple but never checkered; stamens a trifle shorter than the perianth. Orient. Fls. end of April or beginning of May. B.M. 1537. Var. **mìnor,** Sims, B.M. 962 (excluding synonymy), has smaller fls. and anthers barely exserted.

20. **libanótica,** Baker. Closely resembling No. 19, but with 6–30 strongly odorous fls., pale lilac, with darker vertical veins; stamens a third shorter than the perianth; anthers purplish. Palestine, rocky and shady parts of Mt. Lebanon.

21. **plurifiòra,** Torr. PINK FRITILLARY. Height 6–12 in.: lvs. few, mostly at the base, oblong-lanceolate, about 4 in. long: raceme 4–12-fld.; fls. rosy purple, not checkered, the glands not evident; stigma shortly 3-lobed. Calif. G.C. III. 21:231.—Blooms early. **F. Púrdyi,** Eastw., differs in the fl. being white beautifully tinged purple. Humboldt Co., Calif.

22. **lanceolàta,** Pursh. Sts. 1–3 ft.: lvs. 4–10, lanceolate, whorled on the upper part of st. (or sometimes scattered), ovate-lanceolate, 2–4 in. long: fls. 1–4, bowl-shaped, dark purple mottled greenish yellow, somewhat variable in color; segms. ovate to oblong, concave, with large gland. Calif. Var. **grâcilis,** Wats. Fls. very small with narrow and more acuminate segms., deep purple or almost black. Var. **floribûnda,** Benth. (*F. mùtica,* Lindl.). Fls. 3 to many, dark purple or greenish and conspicuously spotted or checkered, the segms. crisped or erose.—The bulbs of *F. lanceolata* live one year; the scales are few or none, and the bulb is covered with rice-like bulblets (whence the name "rice-root lily").

23. **parviflòra,** Torr. St. 5–20-fld.: lvs. about 9, mostly whorled, linear: fls. purple, suffused green, not checkered, on short and strongly recurved pedicels; segms. with shallow nectaries. Sierra Nevadas in Calif.

24. **atropurpûrea,** Nutt. St. 1–6-fld., lower and more slender than in No. 23: lvs. 12–20, scattered or imperfectly whorled: fls. dark purple obscurely checkered with green, on slender pedicels. Wyo. and Utah, to the Sierras and the Columbia River.

25. **coccínea,** Greene. SCARLET FRITILLARY. St. 1–4-fld.,

1583. The Crown Imperial.—Fritillaria Imperialis.

slender, 12–18 in. high: lvs. 3–7, in 2 or 3 whorls at middle of st., narrow-linear: fls. scarlet, slightly mottled within with yellow. Calif.—Said to be very like *F. recurva*, but lower and less leafy and the fls. of different color; it has a smaller bulb and takes more readily to cult.

26. **Imperiàlis,** Linn. (*Imperiàlis corondta*, Dum. Cours.). CROWN IMPERIAL. Fig. 1583. Height 2–3 ft.: lvs. numerous, crowded, ascending, ½–1 in. wide, highest often in whorls of 8–10: fls. end of March. B.M. 194 and 1215. Gn. 46, p. 101; 52, p. 243. A.G. 13:488. R.B. 20:196.—There are single and double forms in yellow and red, and kinds with foliage striped white, and with gold. There are varieties Aurora, Maximus, and William Rex, red; Sulphureus, sulfur-yellow; and Crown upon Crown, Couronne Orange, Red Slagzwaard and others. Var. **longipétala,** Hort. Gn. 56:358, with long segms. Var. **chitralénsis,** Hort., has rich yellow fls.: said to be a common form in Chitral (British India). G.C. III. 47:171. G.M. 54:682. **F. Raddeàna** Regel, from Turkestan, is somewhat dwarfer, blooms earlier, has floral lvs. recurved-spreading, fls. straw-colored or greenish yellow and shorter than the pedicels.

27. **recúrva,** Benth. Height 6–24 in.: st. 2–8-fld., purple, mottled green: lvs. 6–12, lower ones in whorls of 3–4, linear, ascending: fls. narrow, bell-shaped. Calif., Ore. B.M. 6264. Gn. 18:458; 59, p. 415; 61, p. 336. —This has stamens only a little shorter than the perianth, while in the next 3 species they are only half the length of the perianth. Distinct by the color of the fls., which are bright red outside without a trace of purple, and brilliant yellow inside, spotted with red.

28. **liliàcea,** Lindl. WHITE FRITILLARY. Height 3–12 in.: st. 1–6-fld.: lvs. on st. few, linear-oblong or linear, those of the radical tuft narrowly or broadly oblong: fls. between funnel- and bell-shaped, whitish, veined green, not checkered; gland at base of segms. greenish and purple-dotted. Calif. in Coast Range from San Francisco south. Gt. 1871:715.

29. **biflòra,** Lindl. BLACK LILY. CHOCOLATE LILY. Height 6–18 in., stout: st. 1–3-fld.: lvs. 2–6, most of them near the base, scattered or whorled, oblong: perianth greenish or dark purple or lined with purple; segms. elliptic-obovate, with a greenish longitudinal band. S. Calif.—Fls. often described as dark chocolate-brown to nearly black.

30. **camtschatcénsis,** Ker-Gawl. Mostly written *kamtschatcensis* and variously misspelled. (*Lilium camtschatcénse*, Linn.). BLACK LILY. Height 6–18 in.: st. 1–3-fld.: lvs. 10–15, lanceolate, the lower ones whorled: fls. livid wine-purple, not checkered, 1¼ in. or less long. Siberia, Alaska. Gt. 5:290. Gn. 25:232; 52, p. 242. F.S. 12:1232. G. 14:362.

F. agréstis, Greene. Bulbs very deep-seated: sts. 1–1½ ft.: lvs. 8–12, oblong-lanceolate to linear-lanceolate: fls. 3–8, on abruptly recurved pedicels, yellowish green, with prominent midnerve on each segm. Calif.—Said by Purdy to occur in 2 forms, one a dainty plant a few inches high with fls. having light green or yellow base-color and heavily lined with brown (Mendocino Co.); the other a foot or two tall and similarly marked, so fetid as to be called "stink bells" (edge of San Joaquin Valley, Contra Costa Co.). Probably not in cult.—*F. askabadénsis*, Mich. St. about 3 ft.: upper lvs. linear-lanceolate, whorled: fls. 5–8, hanging amongst the uppermost lvs., about 1 in. long, bell-shaped, pale yellow-green. Cent. Asia. B.M. 7850. G.C. III. 31:238; 45:184. Gn. 61, p. 256. G.M. 45:745. R.H. 1903:180. J.H. III. 44:293. F. S. R. 1:134.—*F. cònica*, Hort. Lvs. in a rosette: fls. bell-shaped, pale yellow outside and bright yellow inside. Greece.—*F. póntica*, Wahl. St. tall, 1½ ft., leafy at middle, the lvs. broadly lanceolate, lower ones opposite: fls. yellow-green, margined and tipped red, the segms. bearing nearly orbicular nectaries. Asia Minor. Gn.W. 21:407.—*F. tuntàsia*, Heldr. St. 8–10 in.: lvs. long and glaucous: fls. 4–6, bell-shaped, about 1 in. across, intense dark maroon. Greece. Gn.W. 23:435.—*F. Záhnii*, Hort. Fls. bell-shaped, rather large, brown, checkered with green inside and streaked with yellow outside. Greece.

WILHELM MILLER.
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FRŒLÍCHIA (J. A. Froelich, physician of Ellwangen, Germany, monographed Gentiana in 1796; died 1841). *Amarantàceæ*. About a dozen species of woolly or hairy American annuals, found chiefly in W. Indies, Mex. and Brazil, scarcely planted: lvs. opposite, entire or nearly so: spikes opposite, terminal; fls. perfect, 3-bracted; calyx tubular, 5-cleft, hardened and spiny-crested in fr.; stamens 5, with united filaments: fr. an indehiscent utricle, inclosed in the filament-tube. **F. floridàna,** Moq., has been advertised for sale in Amer. It is cult. abroad. Height 1–4 ft., leafless above: lvs. linear to oblong or lanceolate: spikes 2 in. long or more; fls. white and woolly, set off by small blackish bracts: fr. broadly winged and irregularly toothed. July–Sept. B.M. 2603 (as *Oplotheca floridana*). Dry sandy areas, Del. to Fla., and west. *F. campéstris*, Small, is by some authors considered not to be distinct.

L. H. B.†

FROST. Hoar frost or white frost is ice deposited upon the surface of plants or other objects. Sometimes it consists of frozen dew-drops, sometimes of feathery spinelike ice-crystals, but usually both formations are present. The moisture from which the deposit of ice is formed comes partly from the ground, partly from the air, and in the case of plants, probably partly from the plant itself.

The term "black frost" is used when plants are frozen without the appearance of any deposit of ice upon them. It occurs when the temperature falls below the freezing-point (32° F.), but not low enough to cause the moisture in the air to come out in the form of hoar frost.

The term "frost," when unqualified, means simply temperatures that are injurious to vegetation without regard to any deposit of ice. It is in this sense that the term "frost" is used in this article.

Degrees of frost.

With respect to the effect of frost on vegetation, the Weather Bureau recognizes three degrees of frost—light, heavy, and killing. A light frost is recorded when only the tenderest plants are injured; a heavy frost, when the injury to tender plants is more marked and the hardier plants are damaged; and a killing frost, when the staple products of the region are injured severely or are killed. When no deposit of frost occurs and the temperature of the air as indicated by the thermometer falls during the night to 32°, a killing frost is recorded also. Frost charts and frost tables, published by the Weather Bureau, are based on the records of killing frosts only.

How plants are injured by frost.

When ice appears on the leaves or blossoms of the plant, it is evidence that the temperature of the plant is at or below the freezing-point; but if the temperature does not go below 32° F., or does not remain at that point too long, little injury will result to any temperate-zone plants. In fact, the phenomenon that we usually have in mind when we speak of killing by low temperature occurs only when ice forms within the tissue. Careful observers have found that the ice formed in the tissue is nearly always in the intercellular spaces, the water being withdrawn from the cells to form these crystals. Whether the withdrawal of water from the cell is the cause of death or is merely associated with it, is not certain. In case of winter dormant tissue, that is very resistant to low temperature, the injury at a given temperature is much greater when the temperature-fall is very rapid. In the case of a few tissues, like ripe apples and pears and leaves of *Agave americana* and of lettuce, the rapidity of thawing influences the extent of injury at the highest killing temperature of the tissue. However, it is not a determining factor, since, if the temperature be carried somewhat lower, the tissue will kill regardless of the rate of thawing.

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Varieties as well as individual plants differ greatly in their ability to withstand cold, and a temperature that may destroy a plant at one time may cause little injury at any other time. Hence, no general statement can be made with regard to injurious temperatures that will apply in all cases.

The following table indicates the temperatures (Fahr.) that have been found injurious to tree fruits during the blossoming period:

Fruits	Petals closed	In blossom	Setting	Later
Apples	27	29	30	30
Peaches	20	25	28	30
Cherries	22	28	29	29
Pears	27	29	29	30
Plums	30	31	31	29

General atmospheric conditions that cause frost.

The loss of heat that brings the temperature of plants to the freezing-point occurs in two ways,—(1) loss by conduction, and (2) loss by radiation. Loss of heat by conduction occurs when the air in contact with the plant is colder than the plant itself. This allows the heat to flow directly from the plant into the colder air about it. Frosts due to this cause alone result almost invariably from the importation of large masses of cold air, brought down from the upper atmosphere by descending currents, or from higher latitudes by northerly winds, both of which movements usually are active when the weather clears after a storm

Frosts, particularly in the late spring or early fall, result also from loss of heat by radiation. Plants radiate heat continuously. During the day more heat is received by them from the sun than they give off, and the plant becomes warmer; at night plants pour more heat into the atmosphere than they receive from it, hence they become colder.

Radiation proceeds most rapidly when the sky is clear and the atmosphere is quiet. Clouds check radiation, because the heat given off from the earth does not penetrate them easily. Much of it is reflected back toward the earth, warming the whole stratum of air between the earth and the clouds.

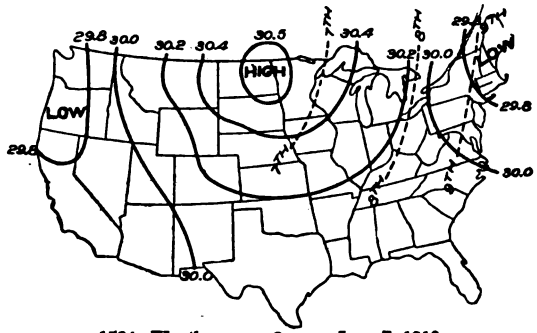
A quiet atmosphere allows the colder, therefore heavier, particles of air to settle to the surface of the earth. Thus, on quiet, clear nights, when frost is likely to occur, the air near the ground may be 10° colder than the air 10 or 15 feet above the ground. The wind, by stiring up the atmosphere, prevents the settling of the cold air, and in this way maintains the stratum of air near the surface at a more nearly uniform temperature.

Frost results seldom from conduction or radiation alone. Both usually are active when frost occurs.

Forecasting frost from weather maps.

Frosts that injure vegetation are a part of the regular weather sequences. The weather comes to us in what may be termed waves that travel with more or less regularity in the middle latitudes from west to east. The weather map is a survey of the atmosphere. It charts the daily progress of these weather waves. By the aid of such a chart it is possible to foresee in a measure the coming of a frost, and to judge its probable extent and severity.

The weather map is based on observations of pressure, temperature, cloudiness, wind, and precipitation, made at many places scattered over a large area. Low atmospheric pressure indicates the trough of the weather wave, and high pressure its crest. The low-pressure area is called the cyclone, because the winds whirl or eddy about its center, the direction of rotation being counter clock-wise in the northern hemisphere. In approaching the center, the winds have an ascending as well as an inward component of motion. The cyclone also is called a storm, because it is attended on its eastern side by southerly or easterly winds, cloudiness, rain or snow, and comparatively high temperature, and on its western side by northerly winds, clearing weather, and a decided fall of temperature.

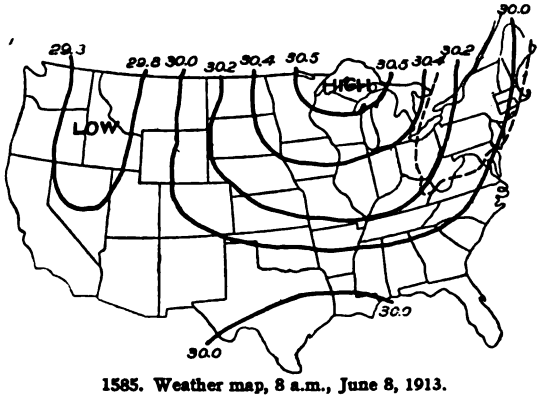


1584. Weather map, 8 a.m., June 7, 1913.

The crest of the wave is indicated by increased pressure, and is called the anti-cyclone. It is so named because its structure is exactly opposite to that of the cyclone. The winds of the anti-cyclone blow outward from its center, and have a downward component of motion; the sky is clear; the precipitation is scanty or absent; and the temperature is comparatively low.

Frosts are most likely to occur in the rear (western side) of the cyclone, and just in front (eastern side) of the crest or center of the anti-cyclone. Here is found the mass of cold air, imported from the north by the northerly winds, and augmented by the cold brought down from above by the gently descending currents; the sky is clear; and as night comes on the air becomes quiet. Thus, the conditions that cause frost are fulfilled.

A weather wave, in which frost was the most pronounced characteristic, moved from North Dakota to the Atlantic coast from June 7 to 10, 1913 (Fig. 1584). The general conditions on the morning of the 7th and 8th (Fig. 1585) are shown by the accompanying weather maps for those dates. The eastward progress of frost from day to day is indicated by the dotted lines on the map of the 7th. The relative position of the cyclone



1585. Weather map, 8 a.m., June 8, 1913.

(low) and the anti-cyclone (high), on the 7th, indicates clearly that frosts will occur over the Upper Mississippi Valley and the Upper Lakes on the following morning, while the conditions shown by the map of the 8th make it certain that the frosts will spread eastward over New York and the New England states by the morning of the 9th.

The Weather Bureau issues frost warnings when frosts are indicated for any part of the United States.

The warnings are distributed by mail, telegraph and by telephone. They are telegraphed at Government expense to many telephone companies.

Forecasting frost from local observations.

It is not possible to forecast frost twenty-four or thirty-six hours in advance without the aid of the weather map; but, by observing the local conditions during the late afternoon and early evening, it is possible often to determine whether a frost will occur before morning. Assuming that it is the frost season, the conditions to be considered are: (1) the character of the preceding weather, (2) the state of the sky, whether cloudy or clear, (3) the direction and force of the wind, (4) the trend of the temperature, and (5) the atmospheric pressure.

Preceding weather.—Since the weather comes in waves, an abnormally warm period is likely to be followed by the opposite extreme.

State of the sky.—A clear sky increases loss of heat by radiation, as explained already.

Direction and force of wind.—A southwest to west wind indicates that the cyclone is passing (except perhaps on the Pacific coast, where other conditions may modify the directions), and that the anti-cyclone is approaching, while a northwest to north wind indicates that the anti-cyclone is near. If the wind dies away it will become colder near the ground.

Trend of the temperature.—If the temperature falls steadily during the late afternoon, reaching 40° by 6 or 8 P. M., with a clear sky and a light wind, frost is indicated before morning.

Atmospheric pressure.—The actual stage of the barometer is not important, except if the pressure has been very low during the day it indicates the passage of a deep depression which is likely to be followed by a high crest. If the barometer rises rapidly during the late afternoon or early evening it indicates the rapid approach of the anti-cyclone.

The influence of local conditions on frost.

Everyone who has lived in the open country is familiar with the fact that some places are more subject to frost than other places. Crops in one part of a field may be destroyed by frost, and in another part of the same field remain uninjured. The explanation for this seeming discrimination is found in the influence of local conditions.

There are five factors that determine the frost risk at any place: (1) location, city or country, (2) elevation and topography, (3) proximity to bodies of water, (4) exposure to the sun, (5) soil and soil coverings.

Location.—Frosts are much more likely to occur in the open country than in cities. Many investigations confirm this. The higher night temperatures of cities is attributed to the heat given off from buildings and pavements, and to the smoke from the many city fires that collects over cities on quiet nights.

Elevation and topography.—The average temperature decreases with elevation above sea-level at a rate of 1° for each 300 feet of ascent. From this it might be expected that hilltops would be more frosty than adjacent lower lands. Such is not the case. On clear quiet nights the colder air that settles to the surface drains away from the hilltops and hillsides and accumulates over the low lands, decreasing the temperature of the vegetation and sometimes causing frost. If the valley into which the cold air drains is closed, so that it cannot flow away as rapidly as it accumulates, a "frost pocket" results. Some farms have many such "frost pockets." A walk over a farm on a clear quiet night often will reveal their location and extent. Low hilltops and hillsides, but not too near the valley floor, should be chosen for fruits or other crops that are liable to be injured by frost.

Proximity to bodies of water.—Under similar conditions, land warms and cools about five times as rapidly as water. During the season of spring frosts, the water is relatively cool, although considerably above the freezing-point. Therefore, it tends to cool the air over adjacent lands during the day and to warm it at night. The influence of a body of water on nearby vegetation is twofold: by lowering the day temperature it retards growth, and by increasing the night temperature wards off frost. The fruit-belts along the various lakes are examples of this twofold influence. The cool air from the lake by day retards the blooming period, and also gives immunity from frost at night. The influence of a body of water is more marked in the fall than in the spring, because of the heat stored up by the water during the summer. It also increases the length of the growing season over adjacent lands by warding off frost both in spring and fall. The distance to which the influence of a body of water will extend inland depends upon the volume of water, its temperature relative to that of the land, the area of its free surface, the slope of its shores. and the prevailing winds. The prevailing winds in the middle latitudes are from the west. Thus, the influence of a lake extends farthest on its east side, and farthest also when the land slopes gently away from the water. The influence of Lake Michigan, mainly because of the gentle slope of its eastern shore, extends nearly half way across the state of Michigan, while the influence of Lake Erie, because of the abrupt rise of its eastern shore, extends inland only a few miles.

Exposure.—Hillsides exposed toward the south are warmest; next come those facing east, then west, and finally north. Frost liability follows in the reverse order, being greatest on the north side. In the eastern states many fruit-growers prefer the northern slope for an orchard site, notwithstanding its greater liability to frost. This preference is based partly on the opinion that the colder soil and air of northern slopes tends to retard the blooming time until the period of spring frosts is passed.

Soil and soil coverings.—Dark-colored, sandy soils, because good absorbers of heat, are least liable to frost. Many cranberry-growers cover the surface of the bogs with an inch or two of sand as a means of protecting from frost. The sand stores up heat by day with which to combat frost at night. Well-drained soils are less frosty than poorly drained soils, because, when the soil is wet, the heat from the sun is expended in evaporating the water, and not in warming the soil. Good tillage reduces the frost risk, because a loose, porous soil absorbs more heat than a hard, compact soil.

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The protection of orchards against frost-injury.

Although much interest has been manifested in the prevention of frost-injury to orchards in recent years, it is well known that the protection of plants and fruits from such injury dates back more than 2,000 years. Pliny the Elder, one of the most noted of Roman writers, who lived from 23 to 79 A.D., states that the Romans practised heating and smudging as a protection against frost-injury. We have no doubt that the practice was successful, since it was recommended by Pliny whose one surviving work, his "Natural History," is considered a storehouse of facts. Smudging was also recommended by Olivier de Serres, a French agriculturist, in the sixteenth century. He recommended the use of wet straw and half-rotten manures so as to produce a heavy smoke. In the latter part of the eighteenth century, the practice of smudging was compulsory in parts of Germany, and failure to comply with certain regulations resulted in prosecution before an officer of the law. According to Boussingault, the celebrated

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French chemist, smudges have been used for centuries on the plains of Cuzco, Peru, on still clear nights by Indians, to retard the loss of heat from the soil. This practice was inherited by them from the pre-Spanish civilization. From the fragmentary pieces of literature we are able to find concerning the matter of frost-prevention, there is no doubt that the practice has been more or less common from the most remote times to the present day.

It is only in recent years, however, that the matter of frost-prevention has been scientifically investigated. The literature on the subject has been, until very recently, of very little importance, because the methods advocated were very crude and could not be used by the commercial fruit-grower. However, during the 1880's and early 1890's, the French vine-growers did some remarkable work. Even at that time, they used heavy oil and tar as fuels, placing these in flat ironware dishes much the same as the modern practice of using smudge-pots with crude-oil. There had also been devised systems of automatic lighting operated by a mercuric column, not very much unlike some of our more recently patented automatic alarm thermometers and self-lighters. About the same time that the French vine-growers were perfecting their work in frost-prevention, the California and Florida orange-growers were also making experiments along the same line. The first successful attempt to prevent frost-injury by the use of heating devices on a large scale occurred in California about 1896. Edward Copely is credited with inventing the wire coal-basket as well as a machine to make it cheaply. These baskets were filled with kindling and about twenty-five pounds of coal, twenty-five to thirty baskets being provided to the acre. They were suspended by wires to limbs of trees. The first use of oil of which there is a record was by Everett at Arlington, California; and the first use of hot water was by Meacham, at Riverside, California. Later, J. P. Bolton, of the United States Weather Bureau, stationed at Fresno, California, devised an oil-pot for use in the vineyards during the period of spring frosts.

1586. Method of protecting windward side of an orchard by doubling the number of orchard-heaters.

The occasion for considerable activity in the matter of frost-fighting at this time was due to a very severe frost in December, 1895, causing great damage to the orange and lemon groves in the Riverside section. It may be said that the beginning of frost-fighting in a commercial way dates from this time. The Riverside Horticultural Club in the winter of 1897–98 took an active interest, and many experiments were conducted, using all sorts of devices for adding moisture to the air by means of fires of damp straw and stable manure, evaporation of water by means of evaporating-pans, sprayers and sprinklers, and by irrigation of the orchards. Boilers were also used with connecting pipes whereby steam was generated and carried to the different parts of the orchards. Direct heating of the air by means of fires was also tried and proved to be the most successful method of preventing frost-injury.

The deciduous fruit-growers of the Sacramento Valley, California, also practised orchard-heating more or less successfully, adopting the methods employed by the citrus fruit-growers of the South. It is remarkable that some of this work did not bear so good results as it should. Fully ten years passed without any advance having been made in the methods of orchard-heating. About 1906, a renewed interest was taken in the work and since that time orchard-heating has been given scientific study. Within the last four or five years the fruit- and vegetable-growers throughout the United States have taken much interest in the practice of protecting their crops from frost-injury, and it has become a recognized part of orchard work in districts in which frosts regularly occur.

The literature on the subject has now assumed considerable importance since it is the result of scientific investigation of frost-injury and frost-prevention at the hands of scientific men. There are many important articles and bulletins on the subject.

The losses occasioned by frost in the citrus and deciduous fruit districts of the United States often reach enormous proportions. It has been impossible to secure accurate information as to what the average annual loss has been over a period of years; but it is safe to say that the loss would approximate $10,000,000 a year. If one takes into consideration the freezes which occurred in the citrus belt in Florida during 1880, 1884, 1886, 1894, and 1895, where not only the fruit but the trees themselves were killed, the loss would average still greater. It is estimated that the freeze of 1894–95 destroyed 3,000,000 boxes of oranges in the Florida groves. Although the citrus industry in California had not yet reached large proportions, the losses were correspondingly heavy. In January, 1913, the losses in the southern California citrus district reached the enormous sum of $50,000,000, all of which might have been saved by means of the present methods of frost-prevention. Deciduous fruits have suffered quite as heavily from frost-injury. Very often almost the entire crop of fruit throughout the eastern and southern states is a complete failure. In the middle West, especially in Colorado, the one great drawback to fruit-growing has been the danger of damage by frost. This has also been true of the deciduous fruit districts of the inter-mountain and Pacific coast states. However, since the advent of the present methods of protecting against frost-injury, much security has been added to deciduous fruit-growing.

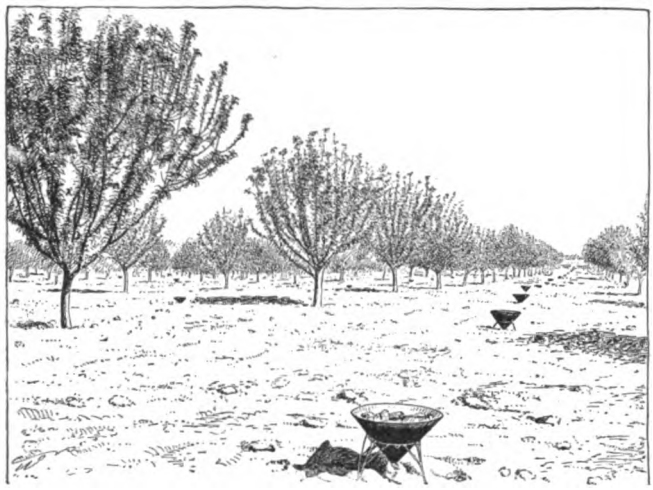
The problem of preventing injury to plants from frost may be classified under the following heads:

1. The prediction of frost, and the issuance of adequate frost-warnings.
2. The construction and use of devices and apparatus to be used in frost-prevention.
3. The cost of orchard heating.
4. The physics of orchard-heating.
5. The use of electricity in frost-prevention.

The prediction of frost and issuance of frost-warnings.

The prediction of frost and issuance of adequate frost-warnings necessarily belong to the United States Weather Bureau. It is wholly impossible accurately to predict frost locally without a knowledge of general weather conditions over a considerable area. However, a local observer with a complete knowledge of the climatology of his district and a knowledge of the air-currents, humidity, maximum and minimum temperatures, and the like, is capable of making very accurate forecasts in coöperation with the United States Weather Service. For careful work, a detailed mapping of the climatological features of each district should be made. It is known that temperatures vary greatly within any district, dependent upon elevation, contour, proximity to large bodies of water, and so on.

Frosts usually occur during periods of high barometric pressure, following a period of low pressure in which there has been some precipitation. Under such conditions the air is very dry and dust-free, producing conditions favorable to intense radiation, and consequently causing rapid cooling of both plants and soil.



1587. Orchard-heating with fifty coal-heaters to the acre. Each heater holds from twenty-five to thirty-five pounds of soft coal.

It has been stated more or less empirically that the temperature of the dew-point is a safe guide in the local forecasting of frosts, but recent investigations have shown that it is not dependable when used alone and in disregard of other important factors, such as the daily maximum temperature, temperature-curve, wind-direction, barometer, and condition of the sky. To this should be added a complete knowledge of general weather conditions as obtained from the nearest District Weather Bureau Office.

In 1882, Lieutenant (now Brigadier General) James Allen published a pamphlet entitled "To Foretell Frost by the Determination of the Dew-point." He said that if the dew-point is above freezing in the early evening the minimum temperature next morning will be above freezing; if the dew-point is below freezing, the minimum temperature next morning will also be below freezing. If the prediction of frosts were so simple, anyone with the aid of the psychrometer, or wet-and-dry bulb thermometer, might easily make independent forecasts. However, it has been found that the dew-point is an aid only when used in combination with a perfect knowledge of the other weather factors and a knowledge of the climatology of the district. The dew-point temperature is used in the Rogue River Valley, Oregon, because it has been found a very safe guide in combination with the above factors which were determined by several years of observation and study. From 1909 to 1913 the average departure of the minimum temperature of the following morning from the previous evening's dew-point temperature during periods of spring frosts has been 0.10 F. It is possible that every district, by a careful study of all the factors governing frost conditions, may be able to predict accurately not only the minimum temperature that will occur, but also the time when the firing in the orchards must begin. This is now done in the Rogue River Valley, Oregon, and has been practised for several years without a single error.

The several ways of preventing fall in temperature.

In order to prevent the fall in temperature, the following methods have been practised: (1) Direct heating of the air. (2) Adding water-vapor. (3) Adding both heat and water-vapor. (4) Ventilation or mixing the air. (5) Irrigation, or use of water. (6) Use of heated water and steam. (7) Use of screens or covers to prevent loss of heat by radiation. (8) Spraying with water.

In the discussion of preventing frost-injury, all the methods excepting that of adding heat will be omitted, as recent experiments have shown that direct heating of the stratum of air in contact with the trees and fruits is the only practicable way of handling frost-prevention on a large scale. All the other methods have been given extensive trials, and, while practicable for small gardens, cannot be used over large areas on account of the large amount of labor necessary, and the further fact that their application cannot be made general. Direct heating is not only simple, but is the least costly, and has, therefore, the advantage of general application.

Methods of direct heating in frost-prevention.—As stated above, it has been demonstrated beyond question that adding heat directly to the air through the agency of fires distributed throughout the orchard is the most successful and practicable way to handle the frost problem in commercial orchards. A multitude of devices and many kinds of fuel have been experimented with, and it is now the opinion among growers who have fought frost that the best heat-producing material so far demonstrated is crude-oil or distillate burned in some form of sheet-iron receptacle or smudge-pot. In the first place, oils are easy to handle, may be readily stored, and, compared with other fuels, produce more heat in proportion to the cost. The cost of handling and igniting such fuels as coal and wood, together with the disadvantage of so much bulky material distributed throughout the orchard which interferes with cultivation, decidedly places these fuels at a disadvantage, excepting in very small tracts. No matter how remote a fruit district may be from an oil-field, there is no question but that oil is the best fuel to be used, especially in large commercial orchards when the labor problem is one of more than ordinary importance. There is very much difference in the oils as secured in different parts of the country. For the most part, eastern crude-oils have a paraffine base, while those on the Pacific slope have an asphaltum base. The crude-oil, or petroleum, as it comes from the wells is very rich in gases and the lighter oils, such as benzene, gasolene, kerosene, and others, and, therefore, is not used as such for orchard-heating. The gases and lighter oils are all removed by fractional distillation, leaving behind the heavier oils and the asphaltum or paraffine base, as the case may be. The fuel-oils on the market are, therefore, residuals, and as such are used for orchard-heating. A residual oil with a paraffine base will burn in the common smudge-pot without

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leaving behind anything but a little soot; but the oils with an asphaltum base do not. For this reason it is found necessary to remove the asphaltum base in so far as is practicable. Asphaltum does not burn readily in a simple smudge-pot, and, therefore, remains behind after the lighter oil has burned. Upon cooling, it becomes very hard, and reduces the capacity of the pot for future fillings. The best oil for orchard-heating purposes is one of approximately 20° Beaumé test, considering the matter of cost as an item. A lighter oil up to 32° Beaumé may be used, but being lighter, it will burn more rapidly and reduce the effective burning time of the orchard-heater.

The orchard-heater.—During recent years, large numbers of types of orchard-heaters have been placed upon the market. As stated elsewhere in this article, the first smudge-pot devised for orchard-heating was the invention of J. P. Bolton, of Fresno, California, and the object of this invention was to produce a device which would effect fairly complete combustion. In fact, the idea in all of the more recent types of orchard-heaters has been to bring about more perfect combustion of the fuel-oil and a consequent reduction in the amount of soot given off. Also, there has been an effort to increase the burning time of the pot by increasing the capacity for fuel-oil. This has been partially effected by several interesting devices, but the perfect pot producing complete combustion of fuel-oil has yet to be invented. The so-called soot-arrester of some types is a misnomer. Very extensive experiments have been made with all the devices on the market, and it has been shown that the plain sheet-iron pot holding approximately five quarts of fuel-oil is just as effective as the more complicated and expensive types. This pot is inexpensive, and when made of No. 29 or 26 sheet-iron will cost from 5 to 8 cents. In using a heater of such small size, the number to the acre should not be less than 100, and preferably more in districts in which periods of low temperature continue more than four or five hours. Owing to the cheapness of such pots, a very large number may be used in preference to using a few expensive heaters of the reservoir type. Many small fires give better results than a few large ones, as the heat is better distributed and convective air-currents are not produced. It must be understood that any orchard-heating device that is in any way complicated by dampers, cocks, valves, and the like, must be avoided. At best, an orchard-heater is roughly handled and the more expensive and complicated types would find a very short existence in actual orchard-heating practice. Furthermore, the matter of storage must be considered. The simple pot which will nest easily and occupy very little space will be more desirable. There is no objection to the high-priced reservoir heater providing it is not complicated, but the same results may be secured by the more simple lard-pail type, holding about five quarts and having a burning time of four and five hours, depending upon the quality of fuel-oil used.

Equipment for orchard-heating.—The equipment absolutely necessary for effective orchard-heating consists of the following:

1. Storage reservoir.
2. Distributing wagon tank.
3. Orchard-heaters.
4. Lighters for igniting the fuel-oil.
5. Thermometers.
6. Frost alarm thermometers.

(1) The storage reservoir should be built of concrete or steel and should have a capacity sufficient to provide for at least five fillings of the orchard-heaters—that is to say, for five frost-periods. Such a reservoir, if built of concrete, should be constructed in such a way as to make the walls and floor one continuous pouring, so as to provide against leakage of oil. Residual oils have no effect upon the concrete, and all leakage is due to improper pouring of the cement. A rich cement mixture should be used. The reservoir should be so placed that it may be filled and emptied by gravity. At best, it is expensive to handle oil, and there should be no pumping. Oil should be secured in tank-car lots, and, if the proper arrangements are made, all the handling may be done by gravity. The reservoir should have an outlet pipe 2½ to 3 inches in diameter and supplied with a close-fitting valve. A cover to keep out dust and rain should also be provided. (2) The supply-tank should be placed upon a heavy low truck and should hold between 300 and 400 gallons. It should be provided either with two heavy gate valves at the rear or with two lines of hose with valves for the purpose of distributing the oil into the orchard-heaters. This tank may be the ordinary supply-tank used to carry spray material. (3) The number of orchard-heaters to be used to the acre will depend upon a knowledge of the conditions under which they are to be used. If the simple one-gallon type of heater is used, at least 100 to 120 should be provided to the acre. Besides, a double row should be placed around the side from which the prevailing air-movement comes in the periods of frosts. In fact, it is best to reinforce all sides of the orchard. After filling the heaters, they should be covered so as to prevent the entrance of moisture or to provide against evaporation of the oil. In placing the heaters, it is best to arrange them somewhere near the intersections of the diagonals made by the trees; but any arrangement which will not place a pot directly under a tree will suffice. (4) Fuel-oil is rather difficult to ignite, and a small amount of gasolene must be used so as to provide for quick lighting. The best method of lighting is to use a machinist's oil-can filled with gasolene, and a torch made of two pieces of thin iron pipe. The larger piece is fitted with a screw cap and is filled with a mixture of kerosene and lard oil. A section of small pipe through which is drawn a piece of waste is then fitted by a reducer to the other end. The waste is kept saturated with the mixture of lard and kerosene and when lighted provides a very good torch. This iron torch is very useful in taking off lids or caps of heaters when lighting. The machinist's oil-can filled with gasolene is carried in the left hand and about two tablespoonfuls are poured on the surface of the fuel-oil in the pots. The torch is applied and the gasolene ignites, firing the heavy fuel-oil. A simpler and lighter torch is easily made by wiring a piece of waste into a ball and twisting the wire into a handle. The waste is kept saturated by plunging it into the oil of the heater, igniting it from the surface flame as it is removed. (5) A most necessary part of any orchard-heating equipment is a sufficient supply of fairly accurate thermometers. There should be at least one thermometer to the acre. The thermometers should be hung with the bulb about 4 to 5 feet from the ground, depending, of course, upon the relative position of the fruiting area of the tree. In many orchards the thermometers will be placed higher, in others, lower. All thermometers should read correctly to within ½°, and if the correction be greater it should be placed upon a tag attached to the thermometer. In reading the thermometers, a pocket electric flashlight is much better than a lantern. The heat from a lantern will cause the mercury to rise before it can be read and the thermometers will, therefore, not give the true atmospheric temperature. The thermometers should be in the open in order to get the approximate temperature of the plants to be protected. This temperature is always slightly lower than the true atmospheric temperature. Besides the thermometers in the orchard, other thermometers placed at a safe distance from the heated area should be provided. A self-registering thermometer, while not necessary as a part of the equipment, would be very useful in determining the actual minimum as well as the rate at which the tem-

perature is falling. (6) The frost-alarm thermometer is a device for sounding an alarm when a certain temperature is reached. This point is usually a degree or two above the danger point, and serves the purpose of giving notice of approaching danger. The thermometer is placed at a point any distance away and where the lowest temperatures usually occur. Wires are led from the thermometer to the house. When the mercury falls below a certain point, the electric circuit is broken and a relay causes a bell to ring. If a thermograph is at hand, the man on duty may easily note by the character of the temperature curve whether or not it may be necessary to prepare for lighting the fires. There are several types of frost-alarm thermometers on the market, but the simplest and most trustworthy of all is the one in which the mercuric column breaks an electric circuit which in turn operates a relay connected with an electric bell.

Besides the above necessary devices for orchard-heating, there have been invented certain automatic devices for lighting a large number of pots at the same time, either by hand or electrical control. Such devices are always complicated, and, disregarding their cost which is an item of considerable importance, they are impractical in large operations. If the means be electrical or mechanical, an expensive cartridge must be used, the cost of which is greater than the cost of the labor for lighting the pots by hand. Besides, all automatic devices require that a large number of wires be strung through the orchard, which would interfere with other orchard practice. As a rule, the period over which frost-injury may occur may be a month or six weeks, and during this time various orchard work must be in progress.

1588. Using wood for orchard heating—fifty fires to the acre.

Injurious temperatures.—The temperatures at which the principal orchard fruits are liable to be injured cannot be accurately stated, since weather conditions previous to a freeze determine to a very great extent the ability of plants to withstand low temperatures. Not only do the different degrees of cold produce different effects on the same plant, but the same plant will often behave differently when subjected to the same degree of cold. It is well known that plants or parts of plants in active growth are more easily killed by low temperatures than the same plants or parts of plants when dormant. Actively growing plants contain large quantities of water; that is to say, the protoplasm or cell-sap is watery, and, as a rule, the larger the proportion of water contained within the plants the more likely they are to be injured by low temperatures. Injury to plants is due to changes or disturbances produced in the protoplasm by low temperatures and, because of the unlike specific characters of different plants, is not always produced in exactly the same way. Some plants are injured at temperatures above freezing, while others are injured by the formation of ice at temperatures which they can withstand if the formation of ice is prevented. Again, some plants are not injured if the formation of ice does not progress too far, while some are resistant to the lowest temperatures. As yet we do not know the nature of the peculiarities which determine the different powers of resistance of individual plants or of the same plant at different stages of growth. It is well known that the resistance to injury can be increased to a certain extent by raising the concentration of the cell-sap. Cold, in itself, acts as a stimulus, inducing an increased production of sugar in many plants. The presence of an increased amount of sugar in a plant acts in such a way as appreciably to lower the freezing-point. While tables giving injurious temperatures to fruit when in bud, blossom, and so on, have been prepared, it is safe to say that these temperatures are not entirely reliable. This is because conditions are never the same in any frost period. It may be stated that in the practice of orchard-heating the safest plan is to keep the temperature just above the freezing-point no matter what the variety of fruit. No doubt, this will often be 2° to 3°, or even more, higher than necessary, but the practice is on the safe side. In orchard-heating practice the temperature should never be allowed to go much below the danger point, as it is usually difficult to bring it back without some chance of injury to the fruit.

Effect of orchard-heating on pollination.—That pollination and subsequent fertilization of the orchard fruits is in any way affected by orchard-heating is yet to be proved. It has been contended by some that the smoke or soot incident to the use of fuel-oil has a tendency to prevent the normal activities of such insects as visit the blossoms of fruit trees. However, there is no proof that the presence of soot on the trees has any effect in keeping insects, especially the honey-bee, away from the newly opened blossoms. Under normal conditions, the blooms which bees visit open during the early part of the day and, therefore, only such blossoms attract them. These blossoms have been closed during the time when smudging was being done, and, therefore, the nectaries, pistils and stamens have no soot deposited upon them. With citrus fruits, soot may have an injurious effect upon the fruit, but it has been found that such fruit may be freed from soot by a washing process which does not materially increase the cost of handling.

The cost of orchard-heating.—The cost of orchard-heating is such a variable quantity that it is almost impossible to make a general estimate which will be of any value. Equipment, cost of fuel, length and number of firing periods, and so on, will vary in different localities and seasons. Orchard-heaters will cost all the way from 6 cents to 50 cents each, and from fifty to two hundred heaters, depending upon conditions, will have to be used to the acre. The quantity of oil will vary with the season, and the cost will be all the way from 1 to 5 or 6 cents a gallon. Usually, no less than 300 gallons an acre should be provided. At least one wagon-tank will have to be provided for each 10 acres at a cost of $25. Lighters and torches will cost from $1 to $2 an acre; thermometers 75 cents to $1 an acre. The cost of a storage-tank charged to each acre will depend upon its size, but will not be far from $10 an acre for large tracts. It is possible to get at the

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actual cost of fuel-oil to the acre in the following way: The quantity of fuel-oil necessary to raise the temperature 5° F. above the surrounding air in an orchard in full bearing with wide-spreading trees will be approximately twelve and one-half gallons an hour to the acre. This will be true if the air remains calm or does not move more than 1 or 2 miles an hour. In young orchards with the fruiting area low, practically double the quantity of fuel-oil as given will be necessary. The simple lard-pail type of heater, or, for that matter, any type of orchard-heater providing a burning area of about 44 square inches, will burn about one quart of fuel-oil an hour. Fifty one-gallon heaters will burn approximately twelve and one-half gallons of fuel-oil an hour, and if this oil costs 4 cents a gallon, the cost of an acre-hour will be about 50 cents when all the pots are burning. In other words, under the above conditions, it will cost approximately 1 cent an hour for each heater used, providing this heater does not have a burning surface greater than 44 square inches. It will require less fuel to heat an orchard in the square form than one of any other shape. The more the orchard-heaters are massed in the form of a square, the better the results. In fact, it is almost impossible to protect an orchard of only a few rows because there is no massing of the heat generated on account of the lack of braking effect on air-movement.

The physics of orchard-heating.

By common consent, the one-gallon or ten-pound lard-pail type of orchard-heater has been made the standard. This heater has a top diameter of 7½ inches, a bottom diameter of 6¾ inches, and a depth of 8 inches. It has a top burning surface of about 44 square inches, an average burning surface of 40 square inches, and under actual field conditions will hold five quarts. As will readily be seen, the rate of burning fuel-oil will not remain constant owing to the form of the pot. Since the rate of burning does not remain constant, it is natural to suppose that a corresponding change in the orchard temperature-characteristic takes place. In other words, the difference in temperature between the air outside the heated area and that in the heated area does not remain constant. The characteristic for any orchard-heater having sloping sides will be approximately the same as for the standard lard-pail type.

1589. Smudging used to prevent frost-injury.

By repeated experiment it has been shown that the standard lard-pail type heater will burn about two pounds (two pints) of fuel-oil an hour, providing the oil is neither too heavy nor too light gravity. A very simple rule which will determine the burning time of any fuel-oil in the standard pot is to divide the weight of a gallon (in pounds) by two. This will give the number of hours a gallon will burn under actual conditions in the field.

For any other size heater of the lard-pail type, the burning time will vary in accordance with the following law: $K=T\,(DH)^2$, in which T=the time of burning, D=the mean of the top and bottom diameters, and H=the depth, K=a constant. In other words, it has been found that if the mean diameter times the depth be squared and multiplied by the burning time (in hours) of a unit quantity (one gallon) of fuel-oil, the product will be the constant for the same fuel-oil burned under the same conditions, no matter what the size of the pot may be, providing it is not too much out of proportion.

The calorific power of fuels.—Analyses of various fuel-oils on the market have shown that the heating power averages about 18,000 British thermal units to the pound. A pound of dry pine wood, or, for that matter, the best oak wood, if perfectly dry, will generate about 6,000 B. T. U.'s under perfect combustion; bituminous coal under the same conditions will generate 12,000 B.T.U.'s. It will be seen, therefore, that the ratio of wood, coal and fuel-oil is about as 1:2:3. A cord of well-seasoned pine will weigh about 2,000 pounds and that of oak about 4,000 pounds. These figures are, of course, only approximate, but will serve as a basis for calculation in case anyone should desire to use wood or coal for orchard-heating purposes. Since the calorific power of fuel-oil is about 18,000 B.T.U.'s to the pound, the standard fuel-pot burning two pounds of fuel-oil an hour will generate 36,000 B.T.U.'s. This is largely theoretical as, owing to the character of the heater, combustion is by no means perfect. Nevertheless, the amount of oil, as indicated, is consumed, and will, therefore, be accounted for on the basis of complete combustion. By repeated experiment, it has been shown that the quantity of fuel-oil necessary to raise the temperature 5° F. above the surrounding air in an orchard in full bearing with the trees forming a protective covering and the air calm or moving not more than 1 or 2 miles an hour, is approximately twelve and one-half gallons or 100 pounds an hour to the acre. This quantity of fuel-oil is approximately the amount which would be burned in one hour by fifty standard orchard-heaters. In very young orchards, or with a wind of 10 to 15 miles an hour, fully two or three times as much fuel-oil will be necessary to maintain a temperature 5° F. above that of the surrounding air. Under average orchard conditions, with the trees in good bearing, the maximum height at which the bulk of the fruit crop is borne is usually not more than 12 to 15 feet above the surface of the ground. In many cases frost-injury does not occur above this height, the cold-air stratum being relatively thin. During periods of injurious low temperatures, the atmosphere is very dry and, therefore, calculations may be based upon the heating of the air only, since the small amount of water-vapor present at such times is of little importance. Taking an acre as the unit area, and assuming that the height to which the air must be heated to protect the crop is 12 feet, the total weight of the air inclosed within this space would be 42,000 pounds. As stated above, a pound of fuel-oil has a thermal capacity of 18,000 B. T. U.'s, and since it will require 100 pounds of fuel-oil an hour to the acre to maintain the temperature of the air 5° F. above the surrounding atmosphere, 1,800,000 B. T. U.'s or about 700 mechanical horsepower will be expended an hour to the acre on 42,000 pounds of air. But 1,800,000 B. T. U.'s would raise the temperature of 360,000 pounds of water 5° F., and since the specific heat of air is 0.24, it would raise the temperature of

1,500,000 pounds of air 5° F. However, it is seen that 1,800,000 B. T. U.'s are just capable of maintaining 42,000 pounds of air 5° F. above the surrounding atmosphere when there is no wind-movement. This means that even with large trees having the ability of reflecting back a considerable amount of heat, and with the soot and smoke acting more or less as a blanket, the loss by radiation, convection and absorption is enormous. As a matter of fact, $\frac{97}{100}$ of the heat generated by the orchard-heaters is lost, and the efficiency is, therefore, less than 3 per cent. Though effective and well within the financial possibility of application, the orchard-heater is nevertheless a wasteful appliance.

In the above calculations, the effects of wind-movement have not been taken into consideration. Take the case of a pot placed in an outside tree row heating a space 25 feet square and 12 feet high. This space contains in round numbers 600 pounds of air. The standard pot will generate 600 B. T. U.'s a minute, or sufficient heat to raise the temperature of 600 pounds of air about 4° F. This will be true if there is no wind-movement and if there is very little radiation of heat. However, if the air moved only 100 feet a minute, or a little more than 1 mile an hour, the temperature could never rise more than 1° above the temperature of the incoming cold air. At 4 miles an hour it could rise but ¼° F. This will be true only in the outside tree rows, on the side from which the air-movement comes. This shows why it is often difficult to protect the outside rows from frost-injury. Naturally, with the orchard in the form of a square, all the rows beyond the first, on account of air-movement, would receive a certain amount of heat from the first row. However, with a high wind of 18 to 20 miles an hour and a temperature of 10° F. or more below the danger-point, the problem of frost-prevention becomes a serious one. The number of fuel-pots must be three or four times the number required for ordinary orchard-heating.

The value of smoke.—The discussion so far has considered mainly the value of fuels from the standpoint of heating. There is some value in the smoke which is generated but very much less than there is in the heat. When it is calm there is little difficulty in maintaining a heavy smudge with only fifty orchard heaters, or fires, to the acre, but a very light breeze will quickly drive it away. Experience has shown that the smudge is valuable when the temperature drops somewhat below the danger-point about sunrise. In cases of this kind, the smoke acts as a screen and prevents the too sudden warming up or thawing of the frozen fruit. However, it is unsafe to depend on smudge alone.

The use of electricity in frost-prevention.—During recent years much thought has been given the matter of frost-prevention by electrical engineers. However, let it be said that some other means than that of direct electrical heating must be employed. If we take the above figures indicating the amount of heat energy which must be expended to the acre to raise the temperature 5° F. in an orchard and maintain it above that of the surrounding atmosphere, we find that this is equivalent to approximately 700 H. P. of mechanical energy. In the transmission of electrical energy from the source of power, there is always a heavy loss, so that fully 1,000 H. P. of mechanical energy would have to be generated in order to raise the temperature 5° F. in an acre of orchard. From this it will be seen that, although our large electrical power plants are carrying a very light load during the hours of 1 A.M. to 7 A.M., the amount of reserve power would be so small in comparison with the demands that the largest power plant would cover but a very small area. Of course, this consideration takes into account the conversion of mechanical energy into heat energy. In actual practice, the electrical heater is so inefficient that it is wholly beyond the range of possibility for orchard-heating. The problem of frost-prevention by electrical methods must be attacked from a different side, either by the use of high tension discharges or by the use of large electric fans that will tend to stir the air or produce a chimney effect so as to carry the cold air upward. Even the latter will be useless when very low temperatures are accompanied by high winds.

A simple method of estimating the quantity of fuel necessary to raise the temperature of the air in an acre of orchard any number of degrees Fahrenheit under every condition is as follows: In a full bearing orchard there are approximately 500,000 cubic feet of air to the acre which must be heated continuously, it being considered that the height to which heat must be added is about 12 feet. By experiment, it has been shown that it will require about 0.75 to 1.00 B. T. U. to the cubic foot an hour to maintain the temperature 1° F. above that of the surrounding atmosphere. Therefore, it will require 375,000 to 500,000 B. T. U.'s an hour, under average conditions to maintain the temperature of an acre of orchard 1° F. above that of the surrounding atmosphere. Since one pound of crude-oil or distillate contains approximately 18,000 B. T. U.'s, the number of pounds of fuel-oil required to the acre-hour will be twenty to twenty-eight pounds. Since a pound of oil is approximately one pint, the quantity of oil an acre-hour for 1° F. rise will be two and one-half to three and one-half gallons. As shown above, the ratio of wood, coal and oil is about as 1:2:3, wood having 6,000, coal 12,000, and oil 18,000 B. T. U.'s to the pound.

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P. J. O'GARA.

FRUIT-GROWING comprises all the knowledge and practice that are directly concerned in the producing and handling of fruits. Pomology (literally, *science of fruits*) is synonymous with fruit-growing. There has been an effort to divorce the terms pomology and fruit-growing, making the former to comprise the scientific and classificatory subjects and the latter the practical subjects; but such division is arbitrary and is opposed to usage. The word "growing" can no longer be held, when used in such connection, to designate merely the planting and care of fruit-plants, for all good practice is necessarily associated with scientific knowledge and theory. Fruit-growing is a more familiar and homely term than the Latin-Greek word pomology, and for that reason it has seemed to some persons to be less adaptable to the formal presentation of the knowledge connected with fruits. It is significant, however, that with the exception of Prince's "Pomological Manual," the fruit books that have done much to mold public opinion in America have not been known as pomologies, notwithstanding the fact that the greater number of them have given great attention to formal descriptions of varieties. The term pomology is founded on the Latin *pomum*, a word that was used generically for "fruit." In later Latin it came to be associated more particularly with the apple-like fruits. The word is preserved to us in the French *pomme*, meaning "apple," and in other languages of Latin derivation. In English we know it as *pome*, a botanical term used to designate fruits that have the peculiar morphological structure of the apple and pear. This use of the term

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is explained under the article *Pyrus*. However, the root of the word pomology is derived from the Latin *pomum* rather than from the botanical *pome*.

The limitations of fruit-growing, as art and discussion, depend on the use of the word "fruit." This word, as used by the horticulturist, is impossible of definition. Products that are classed with fruits in one country may be classed with vegetables in another. To the horticulturist a fruit is a product that is closely associated, in its origin, with the flower. As used in this country, it is the product of a bush or tree or woody vine, the most marked exception being the strawberry. Most fruits may be grouped under three general heads, —orchard or tree fruits, vine fruits (of which the grape is the type), and small-fruits or "berries." Of the orchard fruits, the leading groups are the pome-fruits (apple, pear), drupe-fruits (peach, plum, cherry), and the citrus-fruits (orange, lemon). Of the small-fruits, we may distinguish the bush-fruits (raspberry, blackberry, currant, gooseberry, blueberry), cranberry, and the strawberry. There are many fruits, particularly in the tropics, that do not fall within these groups. The species of fruits that are fairly well known in North America are not less than 150, but the important commercial species are not more than forty.

1590. A vineyard of American grapes (New York). Picking-crates are shown in the foreground.

Fruit-growing is the most important and characteristic horticultural interest of North America. It is of high excellence as measured by commercial standards, quantity of product, and the quickness with which scientific theory and discovery are applied to it. Most remarkable examples of the quick assimilation and application of theoretical teachings are afforded by the readiness with which fruit-growers within recent years have adopted the ideas associated with tillage, spraying, pollination, fertilizing, pruning, inter-planting, and the modifications in conditions of marketing. Yet, great as have been the advances, progress has only begun; and in the precise and painstaking application of the best teaching the American fruit-grower has much to acquire.

The American ideals in fruit-growing are quite unlike the European. The American aims at uniformity over large areas. The European gives more attention to special practices, particularly in training of fruit trees. This is well illustrated in American nurseries as contrasted with European nurseries (see *Nursery*). The American merely prunes his fruit trees in the nursery: he does not train them. The American is likely to give most attention to the fruit by the bushel or by the barrel; the European is likely to consider his fruits singly or in small numbers, and often to sell them by the piece or by the dozen.

In many parts of North America, the extension of fruit-growing is the most radical change of base taking place in farming operations. This growth of the fruit business is possible because the consumption of fruit is increasing, the facilities for transportation have been improved, scientific discovery has insured the production of good crops, and also because many other kinds of farming have been relatively unprofitable.

While the phenomenal development of American fruit-growing has been due in great measure to climatic and economic conditions, it also has been hastened by book writings. More than fifty authors have contributed books of greater or less size, either on the general subject or on special fruits, beginning with Coxe's "View of the Cultivation of Fruit Trees" in 1817, and followed by Thacher's "American Orchardist" in 1822. These pioneer writings gave much of their space to orchard management, with little mere compilation of descriptions of varieties. Subsequent volumes, for nearly fifty years, were in large part compilations and collations of accounts of varieties. To this latter class belong the works of Prince, Kenrick, Downing, Thomas, Warder. It is only in the present time that we have come to treat the subject fundamentally, by giving the weight of discussion to principles of orchard management. (For lists of books, see the article *Literature*.) In recent years, the bulletins of the United States Department of Agriculture and of the many experiment stations, and the extensive discussion in the rural press, have greatly spread the knowledge of fruit-growing and have undoubtedly stimulated its practice.

The sources of American fruits—of the species and races that are cultivated on this continent—are chiefly four: (1) Original or early importations of western Asian and European fruits; (2) oriental types, from the China-Japanese region; (3) the introduction within fifty years of fruits from the Russian region; (4) the development of native species. In the first group are included the prevailing types of apples, pears, quinces, cherries, domestica plums, olives, currants, some of the gooseberries. In the second group are citrous fruits, peaches, apricots, Japanese plums, kaki, and others, many of them having come to us by way of Europe. In the third class—the Russian fruits—are types of orchard fruits of such recent introduction that we have only recently ceased disputing violently about their merits and demerits; therefore a special review of the subject is given at the close of this article. The fourth class—the native fruits—includes the grapes of the eastern states, blackberries, dewberries, raspberries, many gooseberries, strawberries (of Chilean origin), many plums, cranberries, blueberries, and a few apples.

Recently, there has been much interest in fruit-growing on the part of persons who desire to establish themselves on the land. The attractiveness of fruit appeals to them, and they think that the raising of it is not laborious and that the business is adaptable to beginners. This is one expression of amateurism. Fruit-growing entails continuous, active and often hard, disagreeable labor, and, in the case of most orchard fruits, it requires long waiting for perfect results. The business demands much special knowledge, quick action, and first-rate salesmanship. The competition is sharp. Persons should enter the business with caution, and only with a full comprehension of the elements of failure and success. The business has additional risk when one must leave the property to be managed and cared for by hired labor. Usually, the most profitable results are secured when part of the farm is devoted to other products than fruit, for one is then able to employ help and equipment more advantageously, to raise produce for the teams and other live-stock, and to have secondary sources of revenue.

In North America, it is chiefly the commercial large-area fruit-growing that is most highly developed. The amateur phase,—for fancy and for home use,—was

once relatively more important, as explained in a subsequent paragraph. The "fruit garden" is now little seen. It is very desirable, however, that the growing of the choicest fruits in the most painstaking personal way shall be encouraged amongst us; and with the further development of the country this will take place if writers do not overlook the subject.

In Canada, the total yields of fruits for thirty years have been as follows, in quantities (Canada Yearbook, 1910):

Canada	1871	1881	1891	1901
Apples (bushels)	6,365,315	13,377,655	7,519,913	18,626,186
Peaches (bus.)	.....	.....	43,637	545,415
Pears (bushels)	.....	.....	229,240	531,837
Plums (bushels)	.....	.....	266,350	557,875
Cherries (bus.)	.....	.....	192,369	336,751
Other fruits (bus.)	358,963	841,219	320,641	70,396
Grapes (pounds)	1,126,402	3,896,508	12,252,331	24,302,634
Small-fruits (qts.)	.....	.....	.....	21,707,791

The exports of fruits from Canada to all countries has been as follows:

	1906	1908	1909	1910
Apples, green or ripe (barrels)	1,217,564	1,629,130	1,092,066	1,604,477
Apples, dried (lbs)	3,651,260	6,939,088	4,973,562	8,186,984

Of the green apples, the most part went to Great Britain, but the dried fruit went largely to other countries than Great Britain or the United States. Ontario was far in the lead of any other province in fruit-production in 1901, in grapes, small-fruits and apples exceeding all the other provinces combined.

In the United States, the value of fruits (including small-fruits or berries) and nuts produced in 1909 (as reported in the thirteenth census) amounted to $222,024,000, or 4 per cent of the total value of farm crops. The value reported for 1899 was $133,049,000, the increase for the decade amounting to 66.9 per cent. While it is impossible to reduce the quantity of the product to a single total, the statistics for individual classes show that in general the value increased by a much larger percentage than the production. Of the total value in 1909 of fruits and nuts, $140,867,000 was contributed by orchard fruits, $29,974,000 by small-fruits, $22,711,000 by citrous-fruits, $22,028,000 by grapes, $4,448,000 by nuts, and $1,995,000 by tropical and sub-tropical fruits (other than citrous). In both acreage and quantities, strawberries far exceeded any other class of small-fruits; similarly, apples are far in excess of any other orchard fruit; oranges far exceed in value all other citrous-fruits taken together. In nuts, the production in pounds in 1909 was, Persian or English walnuts 22,026,524; black walnuts 15,628,776; pecans, 9,890,769; almonds, 6,793,539; unclassified, 7,988,402. The values of fruits and nuts in 1909, by states, are displayed in Fig. 1593.

The progress in fruit-growing.

The development of American fruit-growing is well illustrated in the radical change of ideals within recent time. These new points of view may be arranged conveniently under seven general heads:

(1) The most important shift is the fact that there is a horticultural industry as distinguished from a general agricultural industry. At the opening of the nineteenth century American agriculture was more or less homogeneous, largely because the extent of it was limited and because there was little demand for other than the few staple commodities. The horticulture of that time was confined chiefly to a small area about the homestead. A few vegetables, flowers and fruits in a small plantation, with here and there a single greenhouse, represented the horticultural effort of the time. At the present day we conceive of great geographical areas as horticultural regions. Persons now buy farms with the explicit purpose of devoting them to the production of fruits or other horticultural products. Even sixty years ago horticulture was largely an amateur's avocation, but today it is one of the leading commercial occupations of the country, and the most important single factor in it is fruit-growing. With this rise of the horticultural industries came a demand for new knowledge on a host of subjects which were unheard of even as late as a half-century ago. The contemporary progress in pomology is largely a breaking away from the old ideals. Practices that were good enough for amateur purposes, or for the incidental and accidental fruit-growing of our fathers, may be wholly inadequate to the new-time conditions.

1591. Young plum orchard, showing clean tillage and high-heading.

Some growers head-in vigorous young trees like the above; others prefer to let them take their natural course, keeping the heads open rather than thick and close. Neither method is best under all circumstances.

A century ago there was practically no commercial orcharding. The apple was grown somewhat extensively in many parts of the country, particularly in New England, but it was used chiefly for the making of cider. Small-fruit growing, as a business, had not developed. In fact, commercial strawberry-growing (the most readily developed of the fruit-growing industries) may be said to have begun with the introduction of the Hovey in 1836, although previously there were market plantations of small extent about some of the larger towns. The commercial culture of blackberries and raspberries, although it began about the middle of the century, did not acquire distinct importance until after the reaction from the Civil War. The fruit-growing industries now constitute a distinct branch or department of our agricultural condition, in the newer regions as well as in the old. In fact, great areas of virgin lands are now put at once into orchards.

(2) With the rise of commercial fruit-growing, there have developed novel questions related to marketing. The new marketing revolves about three centers: (*a*) The necessity for special products for special uses, (*b*) the growing demand for small packages, and (*c*) the remarkable development of transportation facilities and of pre-cooling, handling, and storage. There has arisen an increased desire for special grades and for particular kinds of fruit. The fruits that were current fifty years ago may not be good enough for the markets of today. Commercial fruit-growing rests on the fact that more persons are consuming fruits. Many of these persons buy only in small lots for present consumption. They go to the market often. They have no facilities for storing the fruit, and they do not buy for the purpose of selling. Therefore, the small package has come to be increasingly more important. There has been a

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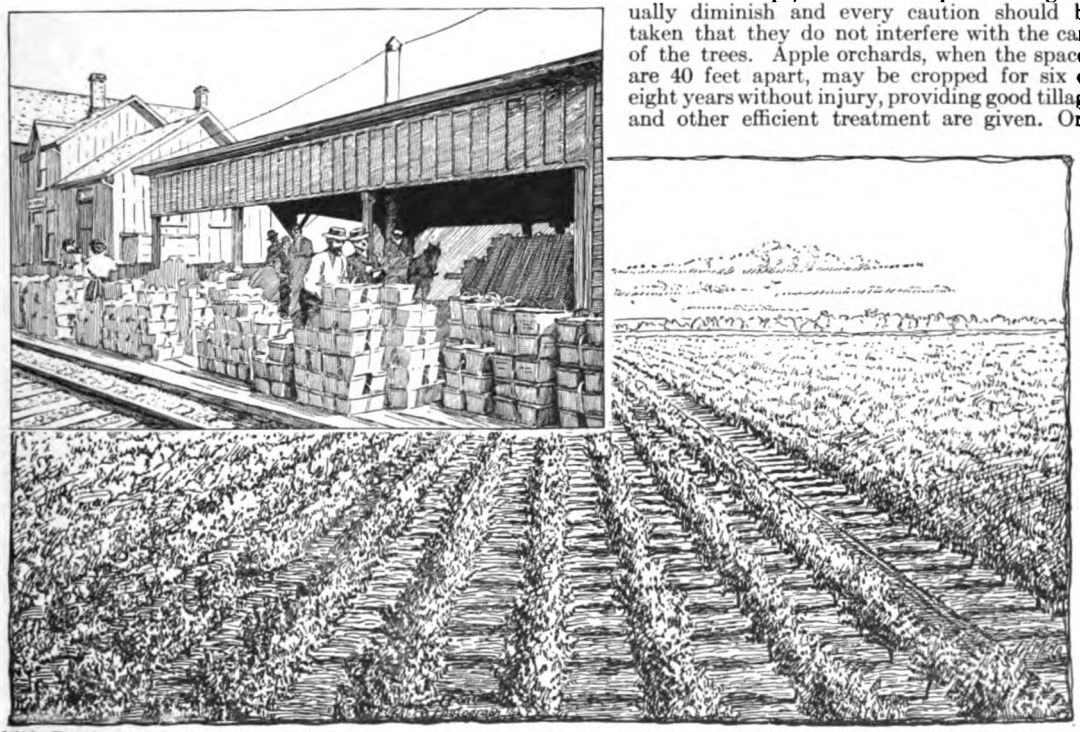
widespread demand for a package that can be given away with the fruit. This demand for the small and individual package may be expected to increase with all the better kinds of fruits or with those that appeal to the personal customer. This is true in all lines of trade. Not so long ago, boots and shoes were distributed in large board cases, but now each pair is sold in a neat cardboard box. We are still conservative in respect to the handling of apples in barrels. In the general trade and for the staple varieties of apples, the barrel may continue to be the best package, but for the personal customer and particularly with all the finer or dessert varieties, a small package must come into use. In most parts of the world, except in the central and eastern part of the United States, apples are not handled in barrels. The fact that the grower must give attention to his package as well as to the growing of his crop, forces him to adopt a new point of view in his fruit-growing and to visualize his market or even his customer.

(3) Modern commercial orcharding has developed the tillage ideal. Under the old régime, the tree was able to take care of itself and to bear a product good enough to meet the uncritical demands. Nowadays, however, the tree must receive the very best of care, for annual crops of great quantity and of the best quality are desired. Therefore, the plant must be supplied with abundance of plant-food and moisture. Time was when it was thought that the mere application of chemical plant-food to the soil would be sufficient to make a plant productive. It is now understood, however, that plant-food is only one of the requisites of good growth. The soil must be deep and loose and fine, so that it will hold moisture and promote all those chemical and biological activities that make the land to be productive. In former times the best attention in tillage was given to the annual crops. The orchard was usually in neglect. This was because the fruit plantation had small commercial importance. Now that the fruit plantation has risen to first importance, in many cases, it must be given as good care as any farm crop. In recent years there has been great development of special tools and implements for the tillage of orchard lands. Greater attention is given to the original preparation of the land, so that planters no longer ask how large the hole must be to receive a tree, but accept Warder's advice that the hole should be as large as the orchard. The philosophy of orchard tillage, as understood by the best teachers and for most parts of the country, is (*a*) to prepare the land thoroughly at the outset, (*b*) to give frequent light surface tillage in the early part of the season or until the crop is nearly or quite grown, and then (*c*) to cover the land with some crop that will remain on the ground over winter and be plowed under in spring. If the land has been well prepared, it is not necessary to plow it deep after the first two or three years, unless one is turning under a heavy cover-crop. The surface tilth may be secured by breaking the top-soil early in spring with a cutaway harrow, gang-plow or other surface-working tools. This may not be possible, however, on very heavy lands. The cover-crop adds humus and protects the land from puddling and baking in the winter. If it is a leguminous crop it also adds a store of available nitrogen. It is possible, perhaps, to use cover-crops so freely that the land becomes too full of vegetable matter, but all such dangers are easily avoidable. Usually the cover-crop is plowed under in spring at the very earliest opportunity in order to save the soil moisture. It is by no means the universal practice to use cover-crops on fruit lands, but the practice is now accepted, and the grower may adopt it or not as his judgment dictates.

To facilitate the economical and efficient tillage of fruit lands, it is coming to be the practice to devote the land wholly to the fruits. The fertility of the land is not permanently divided between trees and hay, or trees and other crops. With plums and pears and some other orchard fruits, it is often allowable to use the intermediate land for the first two or three years for annual crops, but these crops should gradually diminish and every caution should be taken that they do not interfere with the care of the trees. Apple orchards, when the spaces are 40 feet apart, may be cropped for six or eight years without injury, providing good tillage and other efficient treatment are given. One



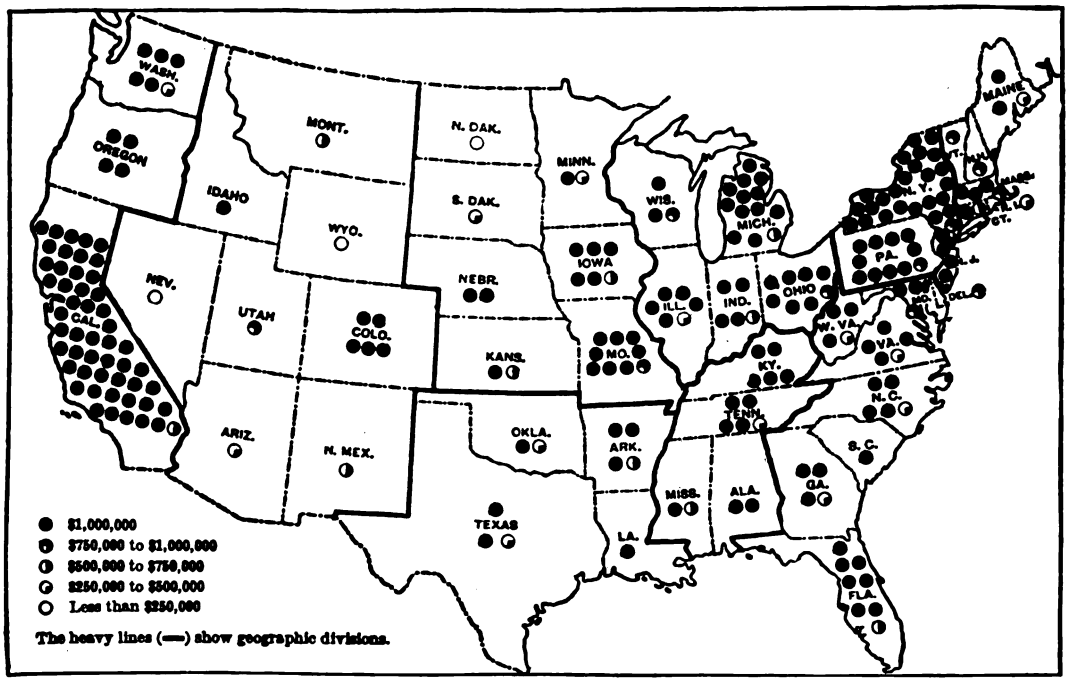
1592. Peach-growing on a large scale in Georgia; also a scene at a shipping-station in the North, showing fruit in small gift packages.

reason for allowing orchards to stand in sod in the old times was the difficulty in plowing beneath full-grown trees. Those persons who desired to plow and till their orchards, therefore, advocated very high pruning. The difficulty with these old orchards was the fact that the land was allowed to run into dense sod. Heavy plowing in an old orchard indicates that the plantation has been neglected in previous years. Orchards that have been well tilled from the first do not require much laborious tillage, and the roots are low enough to escape tillage tools. There has been a development of tillage tools which will do the work without necessity of pruning the tops very high. The practice of tilling orchards has increased rapidly. At first it was advised by a few growers and teachers, but the movement is now so well established that it will take care of itself, and in the commercial orchards the man who does not till his orchard is the one who needs to explain. On the Pacific coast, the importance of tillage is universally recognized because of the dry summer climate. The necessity of tilling orchards has forced a new ideal on the pomologist; and when he goes to the expense of tilling he feels the necessity of giving sufficient care in other directions to insure profitable returns from his plantation. It is true, to be sure, that orchards sometimes thrive under sod treatment, but these are special cases.

Of the same purpose with tillage is irrigation,—the purpose to fit the land for its work. Great fruit regions in the western half of the continent are on an irrigation basis and a special literature on fruit-raising under such conditions is now appearing. This irrigation practice for fruit is another expression of the idea that in the future nothing is to be left to chance so far as it is within the power of the grower to prevent it. For certain intensive fruit-culture, particularly of berries, special irrigation practices are appearing in the East, and often they make the difference between failure and success.

(4) As competition increases, it is necessary to give better attention to pruning. It is unfortunately true that trees will bear without pruning. This, therefore, puts a premium on neglect. The old practice allowed the tree to grow at will for three or four years and to become so full of brush that the fruit could not be well harvested, and then the top was pruned violently. The tree was set into redundant growth and was filled with water-sprouts. This tended also to set the tree into wood-bearing rather than into fruit-bearing. By the time the tree had again begun fruit-bearing, the orchardist went at it with ax and saw and a good part of the top was taken away. It is now understood that the ideal pruning is that which prunes a little every year and keeps the tree in a uniformly healthy and productive condition. The pruning of trees has now come to be a distinct purpose, and this ideal must gain in definiteness and precision so long as fruit trees are grown. The practice proceeds on established principles, and is not of the nature of discipline.

(5) Now that there is demand for the very best products, it is increasingly important that fruits be thinned. The thinning allows the remaining fruits to grow larger and better, it saves the vitality of the tree, and it gives the orchardist an opportunity to remove the diseased specimens and thereby to contribute something toward checking the spread of insects and fungi. Thinning is exceedingly important in all fruits that are essentially luxuries, as peaches, apricots and pears. It is coming also to be important for apples and for others of the cheaper fruits. In the thinning of fruits, there are two rules to be kept in mind: (*a*) Remove the injured, imperfect or diseased specimens; (*b*) remove sufficient fruit so that the remaining specimens stand at a given distance from each other. How far apart the fruit shall be, depends on many conditions. With peaches it is a good rule not to allow them to hang closer than 4 or 5 inches (sometimes 7 or 8 inches), and in years of heavy crops they may be thinned more than this. This extent of thinning often removes two-thirds of the fruits. It nearly always gives a larger bulk of fruit, which brings a higher price. Thinning is



1593. Value of fruits and nuts in the United States in 1909, as displayed by the census.

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usually performed very early in the season, before the vitality of the tree has been taxed, and after the normal "drop" from non-pollination has occurred.

(6) Spraying of fruit plantations has now come to be a definite purpose and an established orchard practice; no good orchardist is now without his spraying appa-

1594. Various spraying rigs. 1. A tall platform rig, to enable one to spray very high trees. 2. A simple barrel outfit for small orchards and small trees. 3. Compressed air outfit. 4. A low rig, with barrel. For larger machines, and other patterns, see pages 1058-1060 (Vol. II).

ratus any more than he is without his tillage tools. When spraying was first advised, the practice seemed to be so revolutionary that great emphasis had to be laid on its importance to induce people to undertake it. How and when to spray and what materials to use are matters that will always be discussed, because the practices must vary with the season, the kind of fruit, the geographical region, the insects and fungi to be combated. Spraying may not be necessary every year, and certainly not equally necessary in all geographical regions; but the fact that spraying is necessary as a general orchard practice is now completely established. A proof of the firm hold that spraying has taken of the fruit-growing business is afforded by the great numbers and the mechanical excellence of the machinery and devices now on the market; and this fact also attests the vitality of fruit-growing as an occupation. A special literature has developed on fruit diseases and fruit insects and the means of combating them, and the grower must keep fully informed by means of the government, state and provincial publications.

(7) Perhaps the most gratifying modern development in fruit-growing is the demand for instruction in fundamental principles, or in the reasons why. Years ago, the grower was satisfied if he had definite directions as to how to perform certain labor. He was told what to do. At present, the pomologist wants to be told what to think. There seems to be a tendency in horticultural meetings to drop the discussion of the mere details of practice and to give increasingly more attention to the underlying reasons and the results that are to be expected from any line of practice. Knowing why a practice should be undertaken and what the results are likely to be, the grower can work out the details for himself, for every fruit plantation and every farm is, in a certain way, a law unto itself. There must be a rational procedure; the details and the applications are complex: therefore the fruit-growing subjects become effective means of education.

Systematic pomology.

The classifying and describing of the kinds of fruits is a particular kind of pomological knowledge that is left to specialists, who are for the most part writers. With the increase in numbers of varieties, it becomes increasingly more important that the most careful attention be given to describing them and to assembling them into their natural groups in order that similar kinds may be compared and also that it may be possible to determine the name by analyzing the specimen. Necessarily, all classificatory schemes for varieties are imperfect since the varieties often differ by very slight characters, and these characters may vary in different regions and under varying conditions. Theoretically, the most perfect classification is one that considers characters of flowers as well as of fruits, but such schemes are usually impracticable because fruit-growers cannot secure flowers and fruits at the same time. For examples of classificatory schemes the reader may consult the various fruit manuals, but the following examples from the older literature will show something of the range and method connected with the problem:

John J. Thomas' scheme for classifying peaches:

Division I. FREESTONES or MELTERS.
- Class I. *Flesh pale or light-colored.*
  - Section 1. Leaves serrated, without glands.
  - Section 2. Leaves crenate, with globose glands.
  - Section 3. Leaves with reniform glands.
- Class II. *Flesh deep yellow.*
  - Section 1. Leaves crenated, with globose glands.
  - Section 2. Leaves with reniform glands.

Division II. CLINGSTONES or PAVIES.
- Class I. *Flesh pale or light-colored.*
  - Section 1. Leaves serrated, without glands.
  - Section 2. Leaves crenate, with globose glands.
  - Section 3. Leaves with reniform glands.
- Class II. *Flesh deep yellow.*
  - Section 1. Leaves serrate, without glands.
  - Section 2. Leaves with reniform glands.
- Class III. *Flesh purplish crimson.*
  - Section 1. Glands reniform.

Following is John A. Warder's scheme for classifying apples, adopted "after a long and careful consideration and study of this subject." See Figs. 1595, 1596.

Class I. *Oblate or flat*, having the axis shorter than the transverse diameter.
- Order I. *Regular.*
- Order II. *Irregular.*
  - Section 1. Sweet.
  - Section 2. Sour.
    - Subsection 1. Pale or blushed, more or less, but self-colored and not striped.
    - Subsection 2. Striped or splashed.
    - Subsection 3. Russeted.

Class II. *Conical*, tapering decidedly toward the eye, and becoming *ovate* when larger in the middle and tapering to each end, the axial diameter being the shorter.
- Orders I and II, as above.
  - Sections 1 and 2, as above.
    - Subsections 1, 2 and 3, as above.

Class III. *Round, globular* or nearly so, having the axial and transverse diameters about equal, the former often shorter by less than one-quarter of the latter. The ends are often so flattened as to look truncated, when the fruit appears to be cylindrical or globular-oblate.
- Orders, Sections and Subsections as above.

Class IV. *Oblong*, in which the axis is longer than the transverse diameter, or appears so. These may also be truncate or cylindrical.
- Orders, Sections and Subsections as above.

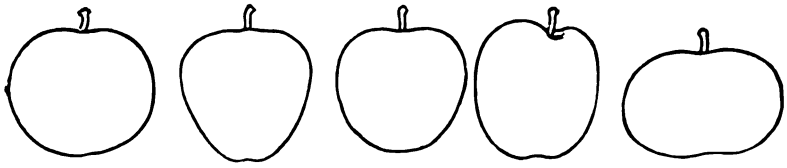
Robert Hogg's classification of pears ("Fruit Manual," 5th ed., London):

A. The length from the base of the stalk to the base of the cells greater than from the base of the cells to the base of the eye.
- Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
- Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
- Section 3. Length from the base of the stalk of the base of the eye equal to the lateral diameter.

B. The length from the base of the stalk to the base of the cells less than from the base of the cells to the base of the eye.
- Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
- Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
- Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.

c. The length from the base of the stalk to the base of the cells equal to that from the base of the cells to the base of the eye.
Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.

A stable and attractive systematic pomology must give careful attention to the names of varieties. In North America much has been done, particularly under the auspices of the American Pomological Society, to simplify and codify the ideas associated with the nomenclature of fruits. The current rules or code of nomenclature of the American Pomological Society are as follows:



1595. The forms of fruits, showing, respectively, spherical, conical, ovate, oblong and oblate forms.

Priority.

Rule 1. No two varieties of the same kind of fruit shall bear the same name. The name first published for a variety shall be the accepted and recognized name, except in cases where it has been applied in violation of this code.

(a) The term "kind," as herein used, shall be understood to apply to those general classes of fruits which are grouped together in common usage without regard to their exact botanical relationship; as, apple, cherry, grape, peach, plum, raspberry, etc.

(b) The paramount right of the originator, discoverer, or introducer of a new variety to name it, within the limitations of this code, is recognized and emphasized.

(c) Where a variety name through long usage has become thoroughly established in American pomological literature for two or more varieties, it should not be displaced nor radically modified for either sort, except in cases where a well-known synonym can be advanced to the position of leading name. The several varieties bearing identical names should be distinguished by adding the name of the author who first described each sort, or by adding some other suitable distinguishing term that will insure their identity in catalogues or discussions.

(d) Existing American names of varieties which conflict with earlier published foreign names of the same, or other varieties, but which have become thoroughly established through long usage, shall not be displaced.

Form of names.

Rule 2. The name of a variety of fruit shall consist of a single word, whenever possible, or compatible with the most efficient service to pomology. Under no circumstances shall more than two words be used. When the exigencies of a case make it appear expedient, such words as early, late, white, red, and similar ones may be used as a part of a name.

(a) No variety shall be named unless distinctly superior to existing varieties in some important characteristic nor until it has been determined to perpetuate it by bud-propagation.

(b) In selecting names for varieties the following points should be emphasized: distinctiveness, simplicity, ease of pronunciation and spelling, indication of origin or parentage.

(c) The spelling and pronunciation of a varietal name derived from a personal or geographical name should be governed by the rules that control the spelling and pronunication of the name from which it was derived.

There are relatively few special technical terms used in the descriptions of pomological fruits. The greater part of them pertain to the pome fruits. The diagrams (Figs. 1595, 1596) illustrate some of these terms: *Spherical*, nearly or quite globular, the two diameters being approximately equal; *conical*, longitudinal diameter equaling or exceeding the transverse diameter, and the shoulders or apex somewhat narrowed; *ovate*, broad-conical, the base more rounded; *oblong*, longitudinal diameter distinctly the longer, but the fruit not tapering; *oblate*, distinctly flattened on the ends. In the true Japanese or sand pears, the fruit is usually apple-form. In Fig. 1596 are shown special parts of the fruit: *basin*, the depression at the apex, in which is the *calyx* or *eye; cavity*, the depression at the base, in which is the *stem* or *stalk; suture*, or the groove on the side of plums and other fruits; *corrugated* or *furrowed* sides. The outline shape of an apple or pear is best seen by cutting the fruit in halves lengthwise; the flat side may then be used to print the form on paper.

If descriptions are to be accurate and comparable, they should characterize all the leading or designative attributes of the fruit, and to a less extent of the plant as a whole. Many persons who are called on to describe varieties have adopted "forms" or regular outlines, in order that all characterizations in any one fruit shall be comparable. The following forms, adopted by the late John Craig, illustrate the points that a good description should cover:

Name.....
form.....*size*.....
cavity.....*stem*.....
suture.....*apex*.....
skin.....*color*.....
flesh.....*juice*.....
stone.....*quality*.....
flavor.....*season*.....
TREE.....
GENERAL NOTES.....
.....
.....
.....
.....
Specimens received from.....*Described by*.....*Date*.....
CHERRY.....*Group.*

Name.....
size.....*form*.....
color.....*skin*.....
cavity.....*stem*.....
basin.....*calyx*.....
flesh.....*quality*.....
texture.....*core*.....
seed.....
season.....
TREE.....
GENERAL NOTES.....
.....
.....
.....
.....
Specimens received from.....*Described by*.....*Date*.....
APPLE.....

1596. Illustrating special terms used in describing fruits, showing, respectively, basin, cavity, suture, corrugation.

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At present, the scoring or judging by points is a favorite exercise in classroom and at exhibitions. The score-card with points or attributes totaling 100 indicates the perfect fruit: the judge puts against the perfect score such percentage of perfection as he thinks the specimen in hand may deserve. This judgment of course varies with the person, as the marks are not mathematical; but experienced judges make very similar or uniform returns on given specimens.

Following are examples of score-cards:

SCALE OF POINTS FOR JUDGING FRUITS.
Established by the Massachusetts State Board of Agriculture.

	No. of points	Score
Quality	20	.....
Form	15	.....
Color	15	.....
Size	10	.....
Uniformity in size	20	.....
Freedom from imperfections	20	.....
Perfection	100	

SCORE-CARD FOR A COMMERCIAL VARIETY OF APPLE.
From "Productive Orcharding," by F. C. Sears.

	General market		Special market	
Tree	40		35	
1. Heavy bearer		20		15
2. Early bearer		10		10
3. Health and vigor		10		10
Fruit	60		65	
4. Fair size		10		10
5. Good color		20		15
6. Good quality		12		25
7. Keeps well		10		10
8. Ships well		8		5
Totals	100	100	100	100

SCORE-CARD FOR APPLES.
F. A. Waugh.

	Scale of points.
Form	15
Size	10
Color	15
Uniformity	20
Quality	20
Freedom from blemishes	20
Total	100

SCORE-CARD FOR PEACHES.
F. A. Waugh.

Form	15
Size	10
Color	15
Uniformity	20
Quality	20
Freedom from blemishes	20
Total	100

ONTARIO SCORE-CARD FOR GRAPES.

	Value of points	Score
Flavor	30	.....
Form of bunch	10	.....
Size of bunch	15	.....
Size of berry	15	.....
Color	10	.....
Firmness	5	.....
Bloom	5	.....
Freedom from blemishes	10	.....
Perfection	100	

SCORE-CARD FOR STRAWBERRIES.
J. R. Reasoner, Ill.

	Scale of points.
Rootage	5
Stock and foliage	5
Vitality, drought-proof	7
Plant-maker	10
Healthfulness, rust-proof	5
Blossoms	5
Staminate.	
Pistillate.	
Productiveness	25
Size	10
Shape	5
Color	5
Flavor	8
Firmness, shipping quality	10
Total	100

CALIFORNIA SCORE-CARD FOR ORANGES.

	Scale of points.
Size	10
Form	5
Color (bloom, 2; peel, 10; flesh, 3)	15
Weight	10
Peel (finish, 3; protective quality, 7)	10
Fiber	8
Grain	4
Seed	8
Taste	30
Total	100

L. H. B.

Russian fruits.

The Russian apples and their close relatives, the Siberian crabs and their hybrids, constitute the hardiest types of pomaceous fruits in cultivation. It was the demand for hardy varieties for the northwestern states and Canada that led to their introduction.

There are four varieties of Russian apples that may be looked on as American pioneers; these are Alexander, Tetofsky, Duchess (Borovitsky) and Red Astrachan. These varieties were imported by the Massachusetts Horticultural Society from the London (England)

1597. Longfield, one of the Russian apples. (×⅓)

Horticultural Society about 1835. They were brought to England from Russia in the early part of the last century by the executive of the latter society. Dr. Hogg is authority for the statement that Alexander was cultivated for 50 years in England prior to 1808. Robert Manning, superintendent of the test garden of the Massachusetts Horticultural Society at Salem, described these varieties from home-grown American specimens in 1839. Their productiveness and the handsome appearance of the fruit attracted attention. Through the efforts of Warder and other western pomologists they were rapidly distributed throughout Ohio, Wisconsin and Minnesota. It would appear that in the last half- or three-fourths-century—which practically covers the pomological history of the West—the periodicity of "hard" or "test" winters has been more or less regular. When the normal or "mild" winter obtains, the apples of the New England states or their descendants do not, as a rule, suffer injury except in the colder parts of Minnesota. These mild winters have followed each other with delusive regularity for periods of ten, fifteen or eighteen years. Under these conditions, fruit-growers have been prone to efface from their memories the effects of the last "test winter" and have planted freely of the American type. With this type have been usually mingled Alexander, Oldenburg and Red Astrachan. It has been invariably noted that after the visitation of an exceptionally cold winter varieties of the Oldenburg or Alexander types were usually unharmed, while Greening, Janet, and Baldwin were killed. "Test winters"—the name has more or less local adaptation

in the West—visited the northwestern states in 1855–6, 1872–3, 1885–6, and also in 1898–9. Thus it is that Oldenburg (Duchess) has become a standard of hardiness among apples in the colder parts of the United States and Canada. Importations of cions were made by nurserymen and fruit-growers between 1867 and 1875, but the main introduction was made by the United States Department of Agriculture in 1870 at the urgent request of the State Agricultural Society of Minnesota, which began the agitation as early as 1867. This importation consisted of young trees secured through the coöperation of Edward Regel, director of the Imperial Botanic Gardens at St. Petersburg. The trees were planted on the grounds of the Agricultural Department at Washington. The collection consisted of about 300 varieties. They were taken charge of by William Saunders, superintendent of gardens and grounds. All available cions were cut and distributed annually for five years. They attracted considerable attention in the colder apple-growing regions. Subsequent importations of cions and trees were made by the Iowa Agricultural College between 1875 and 1880. In 1882 Charles Gibb, of Abbotsford, Canada, accompanied by J. L. Budd, of the Iowa Agricultural College, went to Russia and spent the summer in investigating these fruits. Large importations of apples, plums, pears and cherries followed. In these later importations the east-European fruits were collected without discrimination, and in most instances have been erroneously regarded in this country as authentic Russians.

Russian apples: characteristics and nomenclature.

It is now very difficult to say which are Russian apples, which German, Polish or Swedish. If we were to choose the Astrachan variety as a type of the Russian apple, which in all probability would be a correct basis, only a comparatively small number of varieties could be grouped about it. But this is only one of the several apparently authentic groups which might be erected upon certain characteristics of tree. In addition to Astrachan might be cited (1) Hibernal type: trees vigorous growers, with open spreading tops, and very large, leathery leaves. (2) Oldenburg type: moderate growers, with compact, round-topped heads; leaves of medium size. (3) Longfield type: slow growers; branches horizontal or pendulous; leaves whitish and woolly underneath. The Longfield apple, one of the best known of the Russians, is shown in Fig. 1597. (4) Transparent and Tetofsky type: trees pyramidal; bark yellow; spurs numerous; leaves large, light green. (5) Anis type: trees upright, spreading or vase-shaped; leaves medium, veins reddish. It would seem reasonable to suppose that the Anis family was derived from the Astrachan type. The flesh of the fruit of the various types is very similar.

These represent the principal types of Russian apples. The fruit they bear in the prairie climate matures in the summer, autumn or early winter. It does not appear that any of the especially hardy varieties of undoubted north or east Russia origin are winter kinds when grown in the Mississippi Valley. Such late-keeping kinds as give promise of commercial value appear to have originated in the Baltic provinces or to have been transported at an early date from the countries to the west. These types—the Synaps for instance—have characteristically small leaves, slender twigs, and are less hardy than members of the groups cited above.

The "bloom," or glaucous covering, of the Russian apple is characteristic. It does not persist to the same extent, however under all climatic conditions. In eastern Quebec it fails to develop to the same extent that it does under the drier atmospheric conditions of the eastern states. As additional proof that this pruinose bloom is an immediate climatic effect, one has but to compare the Colorado Spy with that grown in New York. The smooth, thin skin and abundant bloom of the Colorado apple is characteristic in a greater or less degree of all varieties produced in the dry regions adjacent to the Rockies, as it is of the Russian apples in the more arid portions of that country.

The names of Russian apples are much confused. There is no pomological society in Russia to assist the

1598. Vladimir, one of the typical Russian cherries. The fruit is somewhat tapering to the stem. (×⅔)

fruit-grower in eliminating synonyms; on the other hand, the factors conducive to confusion are strongly in evidence. These are illiteracy on the part of the grower and the practice of propagating fruit trees from the seed instead of by grafting. Gibb says "nomenclature in Russia is hopelessly confused. Different names are given to the same apples in different localities, the same name to different apples growing in adjacent districts."

Fruit-growers of the West, realizing that Americans should have a uniform system, at least in the nomenclature of these varieties, called a meeting made up of interested representatives of the fruit-growers' associations of South Dakota, Minnesota, Iowa and Wisconsin. These delegates, collectively styled the "Russian Apple Nomenclature Commission," met at La Crosse, Wisconsin, August 30, 31, 1898. They decided that it would be wise to attempt a grouping to be based upon "family resemblance." In accordance with this the following statement was adopted: "The varieties here grouped as members of the same families, while in a few cases differing somewhat in characteristics of tree, are so nearly identical in fruit that for exhibition and commercial purposes they are practically the same and should be so considered." It is to be regretted that a commission on nomenclature should take such a radical stand as this, because the characteristics of a variety cannot be changed by voting to call it by the same name as the other member of the group which it most resembles and almost, though not quite, duplicates. The trend of modern pomology is to preserve small differences, to differentiate rather than blend. The work of the future will consist in large part in studying small differences with a view of finding closer adaptations. The propriety of ignoring Russian nomenclature and the rule of priority is questionable, but in a measure is defensible on the grounds of a confused Russian nomenclature and the unpronounceableness of Russian names. The findings of the committee have on

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the whole met with the approval of those interested in Russian apples.

Russian cherries.

These, next to the apples, constitute the most clearly defined group of Russian fruits; yet many cherries commonly called Russian are in reality Polish, Silesian or German. The typical cherry of northern Russia is represented by the Vladimir type (Fig. 1598). This was first introduced into America as a distinct variety. Later importations and experience demonstrated that Vladimir was a type, not a variety. This type appears to have been grown in Russia for centuries from seeds and sprouts. In this way a special class has been developed. The Vladimir type is characterized by its dwarf stature—5 to 8 feet high—its peculiarly rounded and compact top, its dark red, meaty-fleshed fruit. Koslov-morello is evidently a light-colored juicy variety of Vladimir. The characteristics of the tree are the same as Vladimir, although when grown from seed in this country the seedlings exhibit considerable variation. The amarelles and weichsels of Germany have been grown in Russia for centuries, generally from seed, and have become specialized forms. Cherries of the Vladimir and Koslov-morello types are the hardiest of the cherries. The Vladimirs have not, as a rule, been productive in this country. The fruit-buds appear to be sensitive to cold and as easily injured as some of the recognized tender types of cherries. Although the trees are hardy, the introduction of this type has not extended the area of commercial cherry-growing in this country farther north than the regions already outlined by the profitable cultivation of Early Richmond.

Russian plums.

The plums imported from Russia do not differ materially from those of the domestica type in cultivation in this country. The trees are probably somewhat hardier than Lombard or Green Gage, but the fruit-buds are subject to winter injury wherever Lombard is uncertain. In the main they have been unproductive. Among the most widely tested varieties are Early Red, Moldavka and Merunka, all of the Lombard type.

Russian pears.

These are hardy handsome trees, but none bears fruit of good quality. Where blight is prevalent they are extremely susceptible. Among the hardiest of the class are Bessimianka (meaning seedless, which is only partly true), Gakovsky and Tonko-vietka. These thrive wherever the climate admits of the cultivation of the Oldenburg apple. The fruit ripens in August, and rots at the core if allowed to mature on the tree.

Russian apricots.

Apricots were brought to Nebraska and Kansas by Russian Mennonites about twenty-five years ago. A few of those named and distributed are likely to be retained in the fruit lists of the West.

Russian mulberries.

Russian mulberries have been widely sold as fruit-bearing plants by enterprising agents, but their use to the fruit-grower should be restricted to hedging and the formation of windbreaks. For these purposes they are valuable in the colder and more rigorous regions.

Russian peaches.

So-called hardy Russian peaches are sold, but they really belong to Bokara or Turkestan. The peaches of the Baltic provinces do not differ essentially from the ordinary Persian strain in form or hardiness.

In general.

The introduction of the Russian fruits has given us hardy types from which to breed varieties for northern latitudes. In Iowa, Minnesota and Wisconsin this work is under way. Seedlings and hybrids are appearing each year, which may be considered valuable additions to the fruit lists of these regions

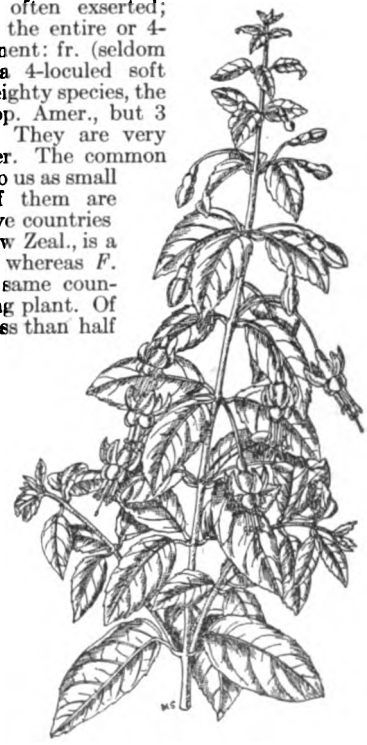
Literature.

But two books appear to have been written on Russian pomology up to 1868, one by Nicolai Krasno Glasov, 1848, the other by Regel, director of the Imperial Botanic Gardens, St. Petersburg, in 1868. The latter is called "Russkaya Pomologaya." It contains a description of 225 varieties of apples, nearly all of Russian origin. A wood-cut of each appears, in addition to 144 colored plates. Gibb calls it "a grand, good fundamental work." American literature on Russian fruits is mainly confined to three sources; the reports of the Montreal Horticultural Society, publications of the Division of Pomology, Department of Agriculture, Washington, and Bulletins of the Horticultural Department of the Iowa Agricultural College. To Charles Gibb, Abbotsford, Canada (Quebec), we are indebted for the faithful and accurate translation of the names given in the collection imported by the Department of Agriculture in 1870. This was adopted by the American Pomological Society in 1885.

JOHN CRAIG.

FUCHSIA (Leonard Fuchs, 1501–1565, German professor of medicine, and a botanical author). *Onagràceæ.* Handsome and popular flowering plants of greenhouses, conservatories, window-gardens and open grounds, blooming most freely in spring and summer.

Shrubs and small trees, with opposite, alternate or verticillate simple lvs.: fls. mostly showy, axillary or sometimes racemose and paniculate, usually pendulous, in shades of red and purplish and with some of the parts often white; tube prolonged beyond the ovary and bell-shaped to tubular, with 4 spreading lobes; petals 4, sometimes 5, or in some species wanting; stamens usually 8, often exserted; style long-exserted, the entire or 4-lobed stigma prominent: fr. (seldom seen under glass) a 4-loculed soft berry.—Seventy or eighty species, the greater part in Trop. Amer., but 3 or 4 in New Zeal. They are very variable in character. The common fuchsias are known to us as small herbs, but most of them are shrubs in their native countries *F. excorticata*, of New Zeal., is a tree 30–40 ft. high, whereas *F. procumbens*, of the same country, is a weak, trailing plant. Of the many species, less than half a dozen have entered largely into garden forms. The common garden kinds have come mostly from *F. magellanica*. This species was intro. into Great Britain from Chile in 1788, or about that time. It is variable in a wild state as well as in cult., and plants subsequently intro. from S. Amer. were so distinct as to be regarded for a time as separate species. Even at the present day some of



1599. Fuchsia magellanica var. globosa. (×¼)

the forms of *F. magellanica* are commonly spoken of as species, so much do they differ from the type. As early as 1848, 541 species and varieties—mostly mere garden forms—were known and named (Porcher, "La Fuchsia, son Histoire et sa Culture"). The fuchsia reached the height of its popularity about the middle

1600. Fuchsia magellanica var. Riccartonii. (×¼)

of the past century. At present it is prized mostly for window-gardening and conservatory decoration. The garden forms of the present day are with difficulty referred to specific types. The long-tubed or so-called speciosa forms are probably hybrids of *F. magellanica* and *F. fulgens* (Figs. 1603, 1604). Others are evidently direct varieties from the stem types. There are many full double forms. For the history and the garden botany of the fuchsia, see Hemsley in the Garden 9:284 and 11:70; also Watson, the Garden 55:74.

In mild climates, fuchsias make excellent outdoor shrubs, some of them withstanding frost. These are of the *F. magellanica* group. They are familiar to travelers in Ireland, and they may be seen as far north as the Shetland Islands. In California, many of the fuchsias are excellent and popular subjects for planting in the open. Under glass, forms of *F. magellanica* may be grown into large rafter shrubs, where they produce great abundance of bloom.

Fuchsias are among the most ornamental and popular of the cool greenhouse flowering plants. They may also be used in summer as bedding plants, and they are among the very few flowering plants that will bloom in the shade. If fair-sized specimen plants in 10- or 12-inch pots are desired, the best time to root them is the end of August. The best cuttings are secured from suckers that start from the base of the plants that are bedded out. The cutting should be 3 inches in length, and if the intention is to grow large specimens, pot them singly in 2-inch pots, in three parts sand, one part loam, and another of leaf-mold. Place the cuttings when potted in a shady position in a temperature of not less than 60° at night. When the very small plants are well rooted, shift them along into a pot 2 inches larger, using this time a compost of equal parts of loam, leaf-mold, and sand and add a third part of well-rotted manure. In this size of pot, the shoot will have made four or five joints, and should now be pinched to encourage side breaks. The plant, where it is stopped, will start into two breaks, and the strongest should be taken for a leader; pinch the weaker one when two leaves are well formed. Strict attention from now on should be paid to keep the plants in good shape. The side shoots must be kept in bounds, so that the symmetry of the plant is preserved, pinching the stronger ones hard and allowing the weaker to grow a little longer so that they gain more vigor. The leader may be allowed to make six pairs of leaves, and then be stopped, always choosing the strongest breaks to increase the height of the plant. Potting should be strictly attended to, never allowing the plant to form a mat of roots around the ball before it gets a shift into a larger pot. The potting material for all future pottings may be composed of two parts good fibrous loam, with an equal amount of well-rotted horse-manure, one part flaky leaves, and one part sharp sand. The whole should be as rough as can be conveniently used when working it equally around the ball of the plant, in the potting operation. It is necessary to have a good straight stake down the center of the plant to support it in an upright position. When the plant is well established in the pot in which it is desired to flower it, manure waterings will be in order, as these plants are gross feeders when in active growth. Green cow-manure, fertilizers, and soot secured from soft coals agree well with fuchsias. The amount to be used is an ordinary handful to two and a half gallons of water. Water twice in between with clean water. Give the last pinch to the plants about six weeks before they are desired to be in full flower.—For bedding-out purposes, cuttings may be rooted in the spring, and grown on into 5- or 6-inch pots. Old plants may be kept through the winter, in a cool light pit, from which frost is kept. Keep them rather dry during October, November, and December, only giving enough water to maintain the wood plump. In January they may be removed to a temperature of 50° by night, allowing a rise of 10° or 15° during the day. This temperature, by the way, is most suitable for fuchsias after they are rooted until they come in flower. After it is seen where all the live eyes are on the old plants, trim them into shape, and remove all the dead wood. Turn them out of the pots, and remove all the loose dirt from the ball with a hose with a gentle pressure of water on it. They may be potted in the same size of pot, and when well rooted in that, give them a shift two sizes larger. Pinch the plants two or three times during the winter, and one will be rewarded with better plants the second year than the first. If well attended to every year, fuchsias may be kept for many years, attaining an enormous size. Fumigate with hydrocyanic gas, during winter, and that, with syringings on all bright days, until they come in flower, will keep down insect pests. (George F. Stewart.)

1601. Fuchsia magellanica var. discolor. (×¼)

INDEX.

alba, 9.
arborescens, 10.
boliviana, 8.
coccinea, 1, 3.
conica, 1.
corallina, 1.
corymbiflora, 9.
decussata, 1.
discolor, 1.
elegans, 1.
exoniensis, 2.
fulgens, 5.
globosa, 1.
gracilis, 1.
hybrida, 2.
Lowei, 1.
macrostema, 1.
macrostemma, 1.
magellanica, 1.
pendulæflora, 5.
procumbens, 11.
Riccartonii, 1.
speciosa, 2.
splendens, 4.
syringæflora, 10.
tenella, 1.
Thompsonii, 1.
triphylla, 6.
variegata, 1.
venusta, 7.

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A. *Fls. drooping* (Nos. 1–9).

B. *Tube of fl. mostly shorter than the calyx-lobes (or in F. speciosa sometimes as long again); petals obovate and retuse, convolute in the bud.*—LADIES' EAR-DROPS.

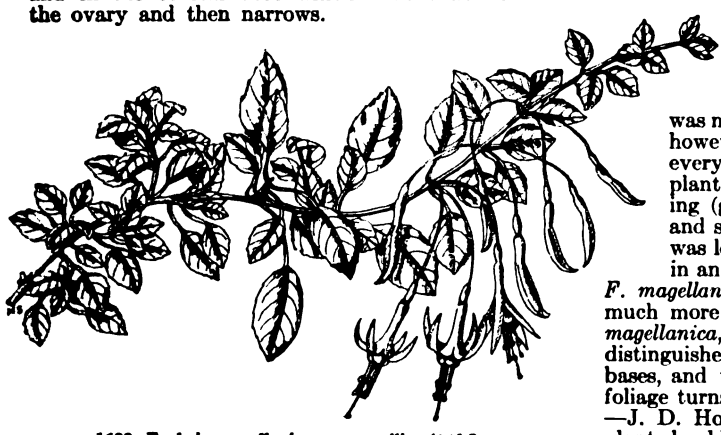
1. **magellánica,** Lam. (*F. macrostèma,* Ruiz & Pav. *F. macrostémma,* Auth. *F. coccínea,* Curtis, not Ait.). Tube little longer than the ovary, oblong or short-cylindrical; petals normally blue, and shorter than the red and oblong-lanceolate calyx-lobes; stamens long-exserted: lvs. opposite or in 3's, lance-ovate, very short-petioled, dentate. Peru and south to Terre del Fuego. B.M. 97 (*F. coccínea*). The leading types are as follows:

Var. **globòsa,** Bailey (*F. globòsa,* Lindl. *F. macrostémma* var. *globòsa,* Nich.). Fig. 1599. Lvs. opposite, short-petiolate, ovate, acute, lightly dentate, glabrous: fls. red-purple, axillary on slender peduncles, small and short, the bud nearly globular and the tips of the sepals cohering even after the fl. begins to burst; tube very short; petals erect, twice shorter than the calyx-lobes. B.R. 1556. Gn. 55, p. 75.—A profuse bloomer, and a common type amongst old-fashioned fuchsias. There is a form with variegated lvs.

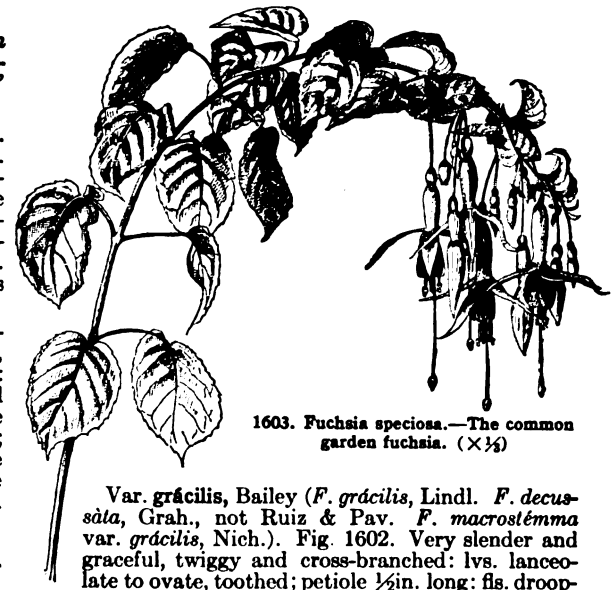
Var. **Riccartonii** (*F. Riccartonii,* Hort.). Fig. 1600. Very like var. *globosa* and reported to be a seedling of it, is a very hardy and floriferous form, standing in the open in Scotland, blooming particularly well in autumn: 6–10 ft., making a trunk 3 in. diam., and becoming wide-spreading: shoots slender: fls. red. J.H. III. 58:329.—A handsome and desirable fuchsia, said to have been raised at Riccarton, near Edinburgh, about 1830, but reported as originating in the Falkland Isls. Excellent in Calif.

Var. **díscolor,** Bailey (*F. díscolor,* Lindl. *F. Lòwei,* Hort.). Fig. 1601. Dwarf, compact and hardy: branches deep purple: lvs. rather small undulate-toothed: peduncles axillary, slender, exceeding the lvs.; fls. red, small, with slender, short tube and wide-spreading, rather narrow calyx-lobes, which are somewhat longer than the tube; petals obtuse, shorter than the calyx-lobes. Falkland Isls. B.R. 1805.

Var. **cònica,** Bailey (*F. cònica,* Lindl. *F. macrostémma* var. *cònica,* Nich.). Shrubby, very leafy: lvs. 3–4 together, toothed, ovate, the petiole one-third length of blade, pubescent: fls. axillary, solitary, on peduncles much longer than lvs.; calyx scarlet, the tube conical (or widest at base) and equaling the lobes; petals dark purple, erect and emarginate; small-fld. Raised from seeds brought from Chile. B.R. 1062.—Lindley says that it differs from *F. gracilis* in having broader lvs., being less floriferous, and in the conical tube which widens above the ovary and then narrows.



1602. Fuchsia magellanica var. gracilis. (×⅓)



1603. Fuchsia speciosa.—The common garden fuchsia. (×⅓)

Var. **grácilis,** Bailey (*F. grácilis,* Lindl. *F. decussàta,* Grah., not Ruiz & Pav. *F. macrostémma* var. *grácilis,* Nich.). Fig. 1602. Very slender and graceful, twiggy and cross-branched: lvs. lanceolate to ovate, toothed; petiole ½in. long: fls. drooping on very long pedicels which are single or in pairs; tube slender, nearly as long as the narrow spreading lobes; calyx scarlet; petals purple, retuse, shorter than the long acute calyx-lobes. Chile. B.R. 847; 1052 (var. *multiflora*). B.M. 2507. Gn. 55, p. 74. Mn. 2, p. 186.—Perhaps a distinct species. A var. *variegàta* is advertised. *F. Thómpsonii,* Hort., is said to belong here.

With the *F. magellanica* set may be classed *F. coralllna,* Hort., *F. élegans,* Paxt., *F. tenélla,* Hort., and others. There are apparently many hybrids. The short-flowered fuchsias are less popular than formerly, but many varieties are now in cult.

2. **speciòsa,** Hort. (*F. hýbrida,* Hort.). Figs. 1603, 1604. The greater part of present-day garden fuchsias are of the longer-tubed type shown in the illustrations. These are probably hybrid derivatives of *F. magellanica* forms and *F. fulgens.* Amongst the named sorts every gradation will be found, from the short-tubed Storm King to the Earl of Beaconsfield with fls. 3 in. long. The old *F. exoniénsis,* Paxt., B.M. 153, is figured as a very showy plant, marked by very long-pointed calyx-lobes and sharp-pointed buds, said to be a hybrid of *F. cordifolia* (a Mexican species) and *F. globosa.* The plant subsequently figured and cult. under that name does not agree, having shorter fls. and much less prominently pointed calyx-lobes.

3. **coccínea,** Ait. Not known to be cult. in Amer., and inserted here for the purpose of clearing up the synonymy of *F. coccinea.* This species appears to have been intro. before *F. magellanica,* and it was named *F. coccinea* by Aiton. *F. magellanica,* however, "usurped its name and spread it to every garden in the kingdom, whilst the true plant lingered in botanic gardens, lastly surviving (greatly to the credit of the Baxters, father and son) in that of Oxford alone." The species was lost from its intro. in 1788 to its rediscovery in an Oxford garden in 1867; meantime forms of *F. magellanica* passed as *F. coccinea.* "*F. coccinea* is much more graceful than any of the varieties of *F. magellanica,* flowers even more freely, and is readily distinguished by the almost sessile leaves with broad bases, and the hairy twigs and petioles; further, its foliage turns of a bright crimson when about to fall." —J. D. Hooker, B.M. 5740. Probably Brazilian. The plant should be looked for in collections.

4. **spléndens,** Zucc. Fig. 1605. Much-branched, shrubby: lvs. ovate-cordate, pale green, serrate: peduncles slender, axillary, solitary and single-fld.; fls. drooping, rather short; fl. 1½ in. long, scarlet tipped pale green, the base swollen and the tube then compressed; petals shorter than calyx-lobes, ovate, greenish; stamens much exserted, the anthers yellow. Mex. B.M. 4082. B.R. 28:67. G.C. III. 45:338. G. 1: 649; 9:693.

1604. The common garden fuchsia—F. speciosa.

BB. *Tube thrice or more the length of the calyx-lobes; petals pointed, nearly or quite as long as the calyx-lobes.*

5. **fúlgens,** Moc. & Sessé. St. somewhat succulent, glabrous, often red-tinged: lvs. large and coarse, cordate-ovate, soft, small-toothed: fls. in terminal leafy clusters or racemes, the red long-tubular calyx-tube 2–3 in. long and very slender at the base; the calyx-lobes short and pointed, greenish at the tip, not very widely spreading; petals deep scarlet, pointed, shorter than calyx-lobes; stamens only short-exserted. Mex. B.M. 3801. B.R. 24:1. Gn. 55, p. 75. R.H. 1881:150 (var. *pumila*).—A brilliant plant, sometimes seen in choice conservatory collections. Evidently one parent of the *F. speciosa* tribes. *F. pendulæflòra,* Hort., is supposed to be a hybrid, but the fls. very long like *F. fulgens:* lvs. ovate, acuminate, with violet midrib: tube of fl. 3–4 in. long, trumpet-shaped; fls. rich crimson shaded maroon. J.H. III. 51:301.

6. **triphýlla,** Linn. Fig. 1606. Low and bushy (18 in. high), pubescent: lvs. often in 3's, small, oblanceolate, petiolate, dentate, green above and purple pubescent beneath: fls. 1½ in. long, in terminal racemes, cinnabar-red, the long tube enlarging towards the top; petals very short; stamens 4, not exserted. St. Domingo, W. Indies. B.M. 6795. Gn. 41:32. I.H. 43, p. 94. G.M. 49:333. Gn.W. 5:389.—Known in botanical collections and sparingly in the trade. The species has a most interesting history, for which see the citations made above. Upon this plant Plumier founded the genus Fuchsia in 1703, giving a rude drawing of it. Upon Plumier's description and picture Linnæus founded his *F. triphylla.* Plumier's figure is so unlike existing fuchsias that there has been much speculation as to the plant he meant to portray. No fuchsia was known to have four stamens or to be native to the W. Indies. In 1877 Hemsley wrote of it: "The figure, however, is so rude that nobody, I believe, has been able to identify it with any living or dried plant. Possibly it is not a fuchsia at all in the sense of the present application of the name, for it is represented as having only four stamens." But in 1873. Thomas Hogg, of New York, secured seeds of a St. Domingo fuchsia which turns out to be Plumier's original, thus bringing into cult. a plant that had been unknown to science for 170 years. It came to the attention of botanists in 1882. For a discussion of further confusion in the history of this plant, see Hemsley, G.C. II. 18, pp. 263–4.

7. **venùsta,** HBK. Branches slender, somewhat hairy: lvs. opposite and in 3's, elliptic, acute, entire, glabrous, somewhat shining: peduncles axillary, slender, about the length of the scarlet fls., more or less racemose above; fls. elongated, the tube 2 in. long beyond ovary and narrow-trumpet-shaped, the lobes ovate-lanceolate and acuminate; petals about equaling calyx-lobes, scarlet, the margins undulate. Colombia. F.S. 5:538. J.H. III. 49:243.

8. **boliviàna,** Carr. Compact, branching, 2–4 ft., producing the showy fls. in profuse drooping sometimes branched clusters: lvs. large, elliptic-ovate, acute or acuminate, toothed: fls. 2–3 in. long, trumpet-shaped, rich red. Bolivia. R.H. 1876:150. G.W. 8, p. 316.—Very like *F. corymbiflora,* but said to be more ornamental: fls. brilliant coral-red, the calyx-lobes and petals acuminate and equal or subequal, the former spreading-star-shaped or reflexed, the petals erect or close about the stamens; filaments red, anthers whitish; stigma very large, ovoid: fr. fleshy, violet-black.

9. **corymbiflòra,** Ruiz & Pav. Tall but weak grower, needing support when allowed to attain its full height, therefore excellent for pillars and rafters: lvs. large, ovate-oblong and tapering both ways, serrate, pubescent: fls. deep red, hanging in long brilliant corymbs; calyx-tube 3–4 in. long and nearly uniformly cylindrical, the lobes lance-acuminate and becoming reflexed; petals deep red, lance-acuminate, about the length of the calyx-lobes; stamens length of the petals. Peru. B.M. 4000. Gn. 11:70 (as F. boliviana); 55:74. F. 1841:161. H. U. 2, p. 324. Var. **álba,** Hort., has white or nearly white calyx-tube and -lobes. F.S. 6: 547. Gn. 55:74. —A very handsome plant, but not common

1605. Fuchsia splendens. (×⅓)

AA. *Fls. erect.*

10. **arboréscens,** Sims (*F. syringæflòra,* Carr.). A shrub: lvs. lance-oblong and entire, laurel-like: fls. lilac-scented, pink-red, small, with a short or almost globular tube, in an erect terminal naked lilac-like panicle; calyx-lobes and petals about equal in length. Mex. B. M. 2620.—Little grown, but excellent for winter-flowering; should not be lost to cult.

11. **procúmbens,** Cunn. Trailing Fuchsia. Trailing Queen. Trailing, with slender much-branched sts.: lvs. alternate, small (⅛–½in. across), cordate-ovate, long-stalked: fls. solitary and axillary, apetalous, the short tube orange and the reflexing obtuse lobes dark purple, anthers blue: plant dicœcious: berry glaucous-

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red. N. Zeal. B.M. 6139. G. 35:97.—A very interesting little plant, suitable for baskets.

Species not known to be in the American trade are: *F. amplìata*, Benth. Fls. large, scarlet, long-tubed, drooping. Colombia. B.M. 6839.—*F. bacillàris*, Lindl. Compact, with short-jointed branches: fls. very small, flaring-mouthed, rosy, drooping. Mex. B.R. 1480. —*F. cordifòlia*, Benth. Fls. 2 in. long, slender, drooping, hairy, red, on very long pedicels. Mex. B.R. 27:70.—*F. Dominiàna*, Hort. Garden hybrid with long drooping red fls. of the speciosa type. F.S. 10:1004.—*F. excorticàta*, Linn. f. Shrub or small tree of New Zeal., reaching 40 ft. high and the trunk sometimes 2–3 ft. diam., the bark thin, papery and loose: lvs. alternate, ovate-lanceolate to lanceolate, entire or nearly so: fls. 1¼ in. or less long, solitary and drooping, trimorphic. B.R. 857.—*F. macrántha*, Hook. Largest-fld. fuchsia; 4–6 in. long, pink-red, in large, drooping clusters. Colombia, Peru. B.M. 4233.—*F. microphýlla*, HBK. Dwarf, small-lvd., with deep red, small axillary, drooping fls.: pretty. Mex. B.R. 1269.—*F. serratifòlia*, Ruiz & Pav. Fls. long-tubed, speciosa-like, on drooping pedicels from the axils of the whorled lvs., pink with greenish tinge: handsome. Peru. B.M. 4174.—*F. simplicicaùlis*, Ruiz & Pav. Lvs. usually in 3's, entire: fls. crimson, long and slender-tubed, in drooping clusters: resembles F. corymbifera. Peru. B.M. 5096.—*F. thymifòlia*, H.B.K. To 6 ft.: lvs. small, opposite or nearly so, ovate or roundish, downy above: fls. red, on axillary pedicels, the petals obovate and undulate. Mex. B.R. 1284. L. H. B.

FUMÀRIA (*fumus*, smoke, the application perhaps to the smoke-like odor of roots or other parts of some species). *Fumariàceæ*, a family by some botanists united with *Papaveràceæ*. This genus includes the common fumitory, *F. officinalis*, formerly held in great repute for various ailments, but now practically banished from medical practice. Seeds are still rarely sold to those who have faith in old physic gardens. The plant has a large literature, which is especially interesting to those who delight in herbals. As an ornamental plant, it is surpassed by Adlumia.

1606. Fuchsia triphylla. (×½)

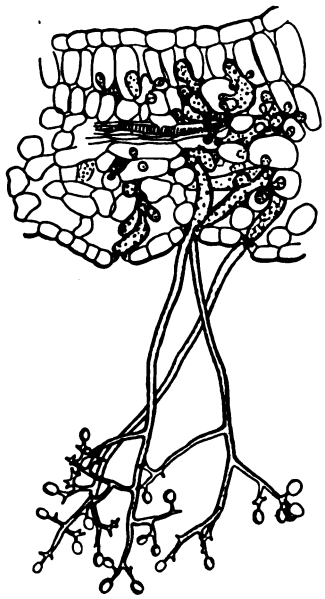
There are about 40 species of Fumaria in the Medit. region and Cent. Eu., and S. Afr.: mostly annual herbs, with compound much-dissected lvs., usually diffuse and branching, sometimes climbing, glaucous: corolla 1-spurred at base, and thereby distinguished at once from Adlumia; sepals 2, very small; petals 4; stamens 6, diadelphous: fr. a roundish 1-seeded indehiscent nutlet. *F. officinàlis*, Linn., the common fumitory, of Eu., is sparingly run wild in waste places: 2–3 ft. high: lvs. petioled, the segms. linear, oblong or cuneate and entire or lobed: fls. small, flesh-color with crimson tip, in narrow racemes. Variable. L. H. B.†

FUMITORY: *Fumaria officinalis.*

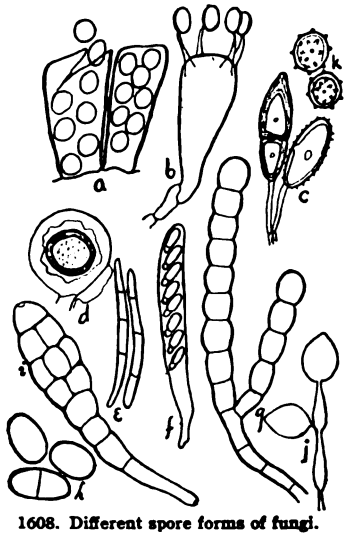
FÛNCKIA, FÛNKIA: *Hosta.*

FUNGI are plants. They differ from other plants chiefly in their lack of chlorophyll, the green coloring matter of green plants, and in the character of the substance of which their cell-walls are composed. This is sometimes spoken of as fungous cellulose, and has characters both of the cellulose of other plants and the chitin of insects. There are thousands of species of fungi, varying greatly in form and structure. Some forms are more or less familiar to everyone; for example, mushrooms, or toadstools, molds, mildews smuts and rusts. Other groups of plants often included under the term fungi are the slime-molds or myxomycetes and bacteria. While they have certain characters in common with fungi, they are sufficiently distinct to be considered separately.

The fungus plant consists of a vegetative feeding portion, the mycelium, which, in a way, corresponds to the roots of higher plants, and the fruiting structure, the sporophore. The latter bears the reproductive bodies, the spores, which, while much simpler in structure, function in the same way as do the seeds of higher plants (Fig. 1607). The sporophore is the part most often observed by the layman. The mushroom or toadstool, the puffball, the smut boil on corn, the white powdery mildew on the grape or rose, or the blue mold on stale bread or cheese, are almost entirely the sporophores and spore masses. The mycelium is usually buried in the substratum from which the food is derived and is thus not often observed. In fact it is often too minute and colorless to be seen with the naked eye. It may be observed as a white branching weft in the dung of mushroom beds or in the leaf-mold in the forest. This form is commonly spoken of as spawn. It may also be seen as a white weft-like growth between the bark and wood of rotting logs or dead trees, or as brown leathery sheets in the cracks of rotting logs. It sometimes appears as brown or black shreds or strands under the bark of dying trees. This form of mycelium strand or rhizomorph is characteristic of the often very destructive mushroom parasite of trees, *Armillaria mellea*. The spores of fungi are minute microscopic bodies cut off from the sporophores for the purpose of reproducing the plant. They are usually one- or two-celled, though often many-celled (Fig. 1608). They are often colorless, though they may be variously tinted or colored, greenish, brown, black, and so on. When placed in



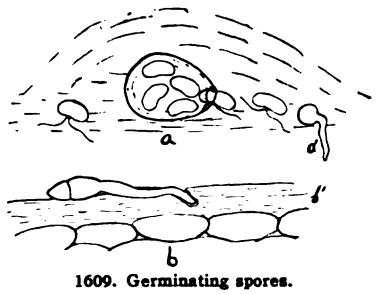
1607. A fungus. A mildew, showing the mycelium in the leaf-tissue and the hanging spore-bearing threads. (Much magnified.)



1608. Different spore forms of fungi.

a, Spore-sacs with spores of the peach leaf-curl fungus; *b*, spore-stalk with spores of a mushroom; *c*, two spore forms of the wheat-rust fungus; *d*, winter-spore of onion-blight parasite; *e*, spores of the beet leaf-spot pathogen; *f*, spore-sac with spores of the black-knot fungus; *g*, the summer-spores of the brown-rot pathogen; *h*, spores of the apple-tree canker fungus; *i*, spore of the alternaria blight fungus of ginseng; *j*, conidia of the late blight fungus of potatoes; *k*, corn-smut spores.

sufficient moisture, and given the proper temperature, they usually will germinate quickly, either sending out a sprout-like germ-tube (Fig. 1609, *b*) which on finding sufficient nourishment grows into mycelium, or the protoplasmic contents of the spore-cell may escape through an opening formed in the cell-wall, as one or more actively swimming and naked protoplasmic masses, called swarm-spores (Fig. 1609, *a*). These swarm-spores swim about in the water for a time, (usually less than an hour), then invest themselves with a cell-wall, and germinate with a germ-tube as above described (Fig. 1609, *a'*).



1609. Germinating spores.

a, Conidium of late blight fungus germinating in a drop of water by swarm-spores; *a'*, swarm-spore germinating by germ-tube; *b*, ascospore of apple-scab fungus sending its germ-tube into the cuticle *b'* of the young apple.

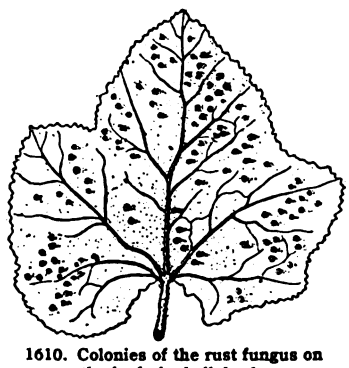
This latter is the method of germination of the potato-blight fungus, *Phytophthora infestans*.—A fungus often produces two kinds of spores, the vegetative spores, conidia (Fig. 1608. *j*), produced usually in great numbers and repeatedly during the season for the purpose of multiplying the form, and the sexual, or resting-spores (Fig. 1608, *a*, *b*, *c*, *d*, *k*), adapted primarily to carry the fungus through periods unfavorable to growth, as dry seasons, winter and the like. Either form may, however, function as the other. They are disseminated by wind, water, insects, or by man himself.

Because of their lack of chlorophyll, fungi cannot assimilate their carbon directly from the carbon-dioxid of the air as can the green plants. They must make use of the food substances already manufactured or elaborated by other plants or animals. With respect to the nature of the substratum from which fungi obtain their food-supply, they are of two general types, saprophytes, those that can feed and develop on non-living organic substances (chiefly dead parts of plants and animals); and parasites, those that may grow upon and take food from living organisms. A true or obligate saprophyte can feed only upon non-living organic substances. There are great numbers of such species, attacking dead and fallen trees, stems and leaves of plants or the dead bodies of animals, infesting dung and other debris, breaking up the complex organic substances into simpler form, and deriving therefrom the food and energy for their development. Most mushrooms, toadstools, molds and the like, are obligate saprophytes, playing the rôle of disintegrators in the ever-changing cycle of nature. An obligate parasite, on the other hand is, in nature at least, compelled to derive its nutrition through direct attack on the living tissues of other plants or of animals. Of such fungi, the rust- and smut-producing parasites, the leaf-curl fungus of the peach, and the potato-blight organism are good examples. Between these extremes are to be found very many forms which, during a part of their active development, live as parasites, and during the remainder as saprophytes. The apple-scab fungus is a good example. It passes the summer as an active parasite upon the leaves and fruit of the apple, but in the autumn and spring continues its growth and development in the fallen leaves, producing the sexually formed ascospores which in the spring infect the next crop. Other forms, which usually lead a saprophytic existence on the dead and fallen parts of plants, may, under special conditions, take on a parasitic habit. A good example is a common saprophyte, a species of Botrytis, common in greenhouses. When there is an excess of moisture or the plants are in any way weakened, this fungus finds it easy to pass from a saprophytic life on the dead leaves, to that of active and destructive parasitism on the living leaves. It is sometimes destructive to lettuce. Fungi are in general favored by abundance of moisture. For this reason in a wet season mushrooms appear in great profusion, and epidemics of plant-disease-producing fungi often occur over wide areas, causing great losses to the agriculturist. The loss from potato-blight in New York state alone often amounts in wet seasons to over $10,000,000. Warm weather is generally favorable to fungus growth, but there are some forms, like the potato-blight fungus, which flourish only during relatively cool periods. This parasite occurs only in temperate regions, being unknown in the hot low lands of tropical and subtropical regions. The peach leaf-curl fungus is apparently favored as much by the low temperature as by the rains of a wet spring. Other forms seem to thrive best in dry climates, as for example the powdery mildew of grapes.

1611. Colonies of a fungus on a plum leaf. The dead tissue sometimes falls out, leaving a shot-hole effect.

While many fungi are destructive agents of the crops of the agriculturist, causing him heavy losses, most fungi are active co-laborers with him, bringing about, as has been seen, the disintegration of compost, on which the farmer depends so largely for increased crop-production. Other fungi, like the yeasts and certain molds, are necessary agents in the arts and manufactures, as for example, the use of yeast in bread-, beer- and wine-production, molds in cheese-ripening, and so on. The value of these fungi lies chiefly in their ability to produce fermentations of various sorts or to give flavors to the products. Many fungi are edible, as for example the large fruit bodies of mushrooms, puffballs and truffles. While their value as food is perhaps often overestimated, they are valuable and form no unimportant part of the food of many people, especially in Europe. They are to be regarded chiefly as delicacies. The truffles and the cultivated mushroom, *Agaricus campestris*, are perhaps the best known. A delicacy known to relatively few is the large smut boils occurring on *Zizania latifolia*. Some fungi are poisonous, as for example the deadly Amanita, the fly-agaric among mushrooms, and the ergot, a fungous parasite of rye and other grasses. Fortunately the number of poisonous species is relatively small.

H. H. WHETZEL.



1610. Colonies of the rust fungus on the leaf of a hollyhock.

FUNGICIDES: *Diseases and Insects.*

FUNTÙMIA (*Funtum* is one of the vernacular names of *F. elastica*). *Apocynàceæ*. Three trees, sometimes very tall, of Trop. Afr., formerly placed in Kickxia, one of them being a rubber tree. *F. elástica*, Stapf, reaches 100 ft., with a cylindric trunk and pale spotted bark: lvs. oblong or lance-oblong, undulate: fls. white or yellowish in short-peduncled many-fld. dense cymes, the corolla-tube constricted above the base, the lobes oblong and obtuse; stamens inserted well down in the corolla-tube; disk 5-parted: follicles oblong-clavate, woody. Offered in Eu.; yields the Lagos caoutchouc.

FURCRÆA (Ant. François de Fourcroy, 1755–1809, chemist). Syn., *Fourcroya, Fourcræa, Furcroya, Furcræa. Amaryllidàceæ*. Succulent desert plants from tropical America.

Some with spiny foliage like Agave, others with minutely toothed margins like Beschorneria. They occasionally bear immense loose panicles of greenish white fls., suggesting those of *Yucca filamentosa*, which are known to every plant-lover of the N. The perianth of Furcræa is whitish and wheel-shaped; in Agave greenish yellow, funnel-shaped. The filaments in Furcræa have a cushion-like swelling at the base, which is absent from Agave.

Furcræa is cultivated much in the same way as Agave, except that the furcreas are given more heat and water. *F. gigantea* has a very pretty variegated form, which makes a useful pot-plant.

As a rule, furcreas bear fruit not more than once, and then die without producing suckers. However, they produce while in flower an immense number of bulbels, which may be used for propagation. It is impossible to say at what size or age the plants will bloom. Grown in pots, they may take a century. On the other hand, plants from bulbels have been known to flower at three years. Seeding is usually rare.

INDEX.

agavephylla, 5.
altissima, 5, 7.
andina, 5.
Barilletii, 8.
Bedinghausii, 3.
Cabuya, 7.
Cahum, 4.
Commelinii, 8.
cubensis, 4, 5, 6, 7.
Deledevantii, 5.
edentata, 6.
elegans, 5.
fœtida, 8.
geminispina, 9.
gigantea, 8.
hexapetala, 4.
Humboldtiana, 7.
inermis, 7.
interrupta, 9.
Lindenii, 6.
longæva, 1.
macrophylla, 5.
marginata, 6.
medio-picta, 8.
pubescens, 5.
Roezlii, 2.
Selloa, 6.
spinosa, 9.
tuberosa, 9.
variegata, 8.
Watsoniana, 8.
Willemetiana, 8.

A. *Lvs. rough-margined but not toothed, glaucous, striate-roughened beneath: infl. pubescent: pedicels short.* SERRULATÆ.

1. **longæva,** Karw. & Zucc. Slender unbranched tree, up to 50 ft.: lvs. rigidly outcurving, narrowly lanceolate, gradually acute, concave, 3–6 x 60 in.: infl. 15 ft., broadly conical, short-stalked; fls. 1¼–1½ in.; ovary rather longer than segm.: caps. elongated, narrowed below; seeds small (⅛ x ¼in.): bulbels unknown. S. Mex. to Guatemala. Zuccarini, Act. Acad. Leop. Carol. 16, pt. 2:48. M.D.G. 26, p. 10. Bateman, Orchid. of Mex. & Guat. Vignette to pl. 16. B.M. 5519, (habit). Herbert, Amaryll., pl. 34.—A similar if separable species is reported for Bolivia. The most remarkable dracænoid tree, flowering when extremely old, and then dying, like others of its genus.

2. **Roézlii,** André (*Agàve argyrophýlla, A. Toneliàna, Beschornèria floribúnda, Lília règia, Lílium règium, Roézlia règia, R. regìna, Yúcca argyræa, Y. argyrophýlla, Y. Parmentièri, Y. Toneliàna*, Hort.). Trunk becoming 6 ft. or more: lvs. rather flaccidly spreading, lanceolate, acute, concave or plicate, 3–5 x 50 in.: infl. 10–15 ft., pubescent, the moderately broad panicle short-stalked; fls. 1¾ in.; ovary and segm. about equal: caps. ellipsoidal, scarcely stipitate: freely bulbiferous, the bulbels elongated. S. Mex. R.H. 1887, p. 353. B.M. 5519 (as to details); 7170 (as *F. Bedinghausii*). G.C. III. 9, p. 489; 36, p. 45; 46, p. 340.—The common plant grown along the Riviera, often as *F. longæva*, but more commonly as *F. Bedinghausii*, with which the synonymy is confused.

3. **Bedinghaúsii,** Koch (*Beschornèria multiflòra*, Hort. *Yúcca Príngle*i, Greenm. *Roézlia* or *Yúcca bulbífera*, Hort.). Trunk scarcely 3 ft.: lvs. rather rigidly outcurving, lanceolate, acute, rather flat, 2–3 x 18–24 in.: infl. 10–15 ft., the rather narrow panicle little longer than the scape; fls. 1½ in.; ovary and segm. about equal: caps. broadly oblong, abruptly stipitate; seeds moderate (¼–⅓ x ½ in.): freely bulbiferous, the bulbels ovoid. Cent. Mex. B.H. 13, p. 327. Ann. Jard. Buitenzorg. II. Suppl. 3:44. G.W. 7, p. 101.

AA. *Lvs. smooth-margined, typically toothed, usually green, not striate.* EUFURCRÆA.

B. *Prickles rather small and close set: lvs. narrow; margin straight.*

4. **cubénsis,** Vent. (*F. hexapétala*, Urban. *Agàve cubénsis*, Jacq. *A. bulbífera*, Salm? *A. hexapétala*, Jacq. *A. mexicàna*, Lam. *A. odoràta*, Pers). Nearly trunkless: lvs. narrowly lanceolate, spreading, smooth, about 2 x 50 in.; teeth nearly straight, ⅛–⅛in. long, ⅔–1 in. apart: infl. 10–15 ft., long-stalked, nearly glabrous; fls. 2 in.; ovary fusiform, about equaling the segm.: caps. small, broad, stipitate; seeds small (¼–½ in.): bulbels ovoid. Cuba and Haiti. Jacq., Stirp. Amer. :175. Ann. Jard. Buitenzorg. II. Suppl. 3:40.—As badly confused as *Agave americana* and actually rarely seen in gardens: apparently the original henequen of early writers on the W. Indies, its fiber called cabuya. A related Yucatan species, the cahum, with less lanceolate lvs. and ovary exceeding the perianth, is *F. Cahum*, Trel., Ann. Jard. Buitenzorg. II. Suppl. 3:39.

BB. *Prickles large or prominently raised and rather distant, curved,—suppressed in certain forms.*

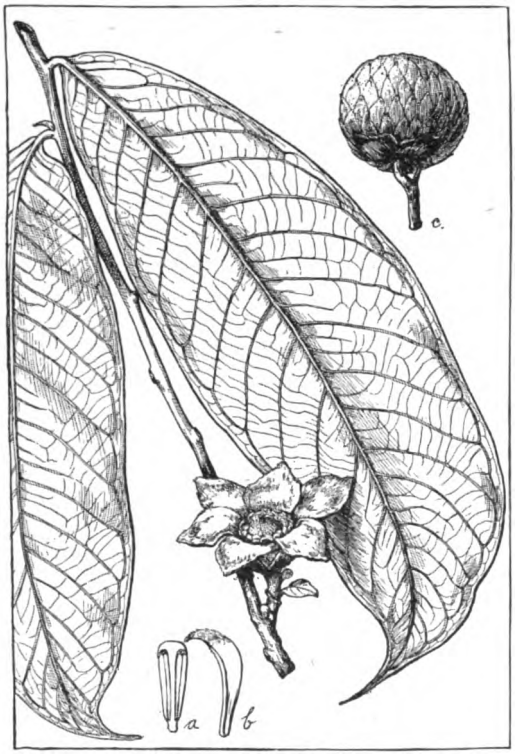
C. *Shape of lvs. oblong-lanceolate, large.*

5. **pubéscens,** Tod. Nearly trunkless: lvs. spreading, concave, smooth, about 3 x 60 in.; teeth ⅛in. long, ⅔–1⅕in. apart: infl. 15–20 ft., rather short-stalked, pubescent; fls. 2¼ in.; ovary 1 in.; segm. 1½ in.: caps. large, broad, variously stipitate: bulbels ovoid. Mex (?). Giorn. Soc. Sci. Palermo 14:5–7. Ann. Jard. Buitenzorg. II. Suppl. 3:43. B.M. 6160(?) (depauperate). Related species are: **F. élegans,** Tod. of Guiana, with lvs. 5 in. wide with hooked blackening teeth ⅛–⅛in. long and 1⅜ in. apart, glabrous long-stalked infl., and leafy-tipped bulbels. Hort. Panorm. 4. **F. macrophýlla,** Hook., established in the Bahamas and Jamaica (probably from the south) with teeth ½in. long and 3⅛ in. apart, broad umbonate caps. and ovoid bulbels. Hook. Icon. 2501. Ann. Jard. Buitenzorg. II. Suppl. 3:37, 45. **F. andina,** Trel. (*F. Deledevántii*, and *F. altissima*, Hort.?), of E. Peru, with nearly as large and distant teeth, short-stalked infl., cuboid caps. and conical-ovoid bulbels. Ceara or Pernambuco hemp is ascribed to *F. agavephýlla*, Brot. (*F. cubénsis*, Mart. *Agàve inérmis* and *A. subinérmis*, Roem.), the caraguata assu of N. E. Brazil., Marcgrav. & Piso, Brazil, p. 111, of this same group.

6. **Sellòa,** Koch. Trunk finally 3–5 ft.: lvs. spreading, concave and revolute or plicate, rough-backed, about 3 x 50 in.; teeth ⅛–¼in. long, 1⅛–1⅗ in. apart, variously curved: infl. tall, stalked, glabrous; fls. 1⅗ in.; ovary ⅔in.; segm. 1 in.: caps. not known: freely bulbiferous. Colombia. B.M. 6148.—Frequently meant when the name *F. cubensis* is used. A handsome white- or finally yellow-margined plant, frequent in cult. is **F. Sellòa marginàta,** Trel. (*F. Lindenii*, Jacobi. *F. cubénsis Lindenii*, Hort. *Agàve cubénsis striàta*, etc., Hort.). Wiesner Festschr., p. 350. I.H. 21:186. G.W. 10, p. 212; 11, p. 135; 16, p. 162. G.C.

III. 23, p. 227 (as *F. gigantea*). A form of this, rosy tinged and without marginal prickles, **edentàta**, Trel., has been intro. from the Colombian Andes recently by Pittier.

7. **Humboldtiàna**, Trel. (*Yúcca acaùlis*, HBK.). Trunk finally 10 ft.: lvs. spreading, nearly flat, grayish, smooth, 5–6 x 60 in.; teeth ⅛–½ in. long, usually divergently twinned from the tops of green prominences, 1–2½ in. apart: infl. 25–40 ft., long-stalked; fls. 2–2½ in.; ovary ⅘–1 in.; segm. 1⅘–1½ in. Venezuela. Ann. Jard. Buitenzorg. II. suppl. 3:38.—Called maguey de cocui by Humboldt; now commonly known as cocuiza brava in contrast with an unarmed cult. form, the cocuiza mansa, which may prove not to differ from *F. inérmis*, Drum. (*F. cubénsis inérmis*, Baker. *F. altíssima*, Hort. Franceschi). B.M. 6543. Intermediate



1612. Fusæa longifolia. (×½)
a, perfect stamen; *b*, petal-like staminode; *c*, fruit.

between this and the next is the cabuya of Cent. Amer., *F. Cabùya*, Trel., which likewise presents armed and toothless forms. Ann. Jard. Buitenzorg. III. suppl. 3:36, 37.

8. **gigantèa**, Vent. (*F. Barilléttii*, *F. fœtida*, *Agàve fœtida*, Linn. *A. gigantèa*, *Aloe fœtida*, Crantz. *Fùnium piliferum*, Willem.). Nearly trunkless: lvs. broadly oblanceolate, nearly flat, undulate, somewhat roughened beneath, 5–8 x 60–100 in., entire: infl. 25 ft., long-stalked, rather narrow; fls. 1⅗ in., with ovary and segm. equal: caps. unknown: freely bulbiferous. S. E. Brazil. DC., Pl. Gr. 126, 126*a*. Redouté, Lil. 476. B.M. 2250. Perrine, Senate Doc. 300:5. B.H. 10:34. Indian For. 35:23. Mart., Fl. Bras. 1:44. Ann. Mus. Marseille. II; 8, p. 125. Squier, Fibre Pl., 2. Jacq. Icon. 379. Commelin. Hort. Amst. 2:18.—The Mediterranean hemp, Mauritius hemp, taretra, green aloe, or pita, intro. by way of Madagascar and hence called Malgache aloe. Varies with moderate toothing, var. **Willemetiàna**, Roem. (*F. Commelínii*, *Agàve Commelínii*, Auct.), the Creole aloe. Ann. Jard. Buitenzorg. II. Suppl. 3:35. With broad median creamy variegation, the unarmed form is var. **mèdio-pícta**, Trel. (*F. gigantèa variegàta*, Hort. *F. variegàta*, Hort. *F. Watsoniàna*, Hort.). G.C. III. 23, p. 243. Ann. Jard. Buitenzorg. II. Suppl. 3:41, 42, 46–8.

9. **tuberòsa**, Ait. (*F. interrúpta*, *F. spinòsa*, *Agàve spinòsa*, *A. campanulàta*, *A. tuberòsa*, *Yúcca supérba*, Auct.). Nearly trunkless: lvs. broadly lanceolate, nearly flat, 8 x 50–70 in.; teeth usually ⅛in. long and ⅔–1⅓ in. apart, sometimes absent toward the end or below: infl. 25 ft.: caps. unknown: freely bulbiferous, the bulbels elongated. Cuba and Haiti and, in somewhat differing forms, in Porto Rico and through the Lesser Antilles. Rep. Mo. Bot. Gard. 18:1–4. R.H. 1877, p. 233. Cyclo. Amer. Agric., II. p. 290. Gt. 1852:3. Yearbook Dept. Agric. 1904:31. Ann. Mus. Firenze. 1:4. Commelin, Hort. Amts. 2:19. —Commonly called silk-grass, sometimes maguey or cocuiza: apparently the Haitian cabuya of early writers. With the teeth twinned, as they are sometimes in *F. Selloa* and characteristically in *F. Humboldtiana*, it is var. **geminispìna** (*F. geminispìna*, Ait.)

WILLIAM TRELEASE.

FURZE: *Ulex*, particularly *U. europæus*.

FUSÆA (probably from Latin *fundo*, signifying melted or fused together, referring to the carpels). *Annonàceæ*. South American trees or shrubs, resembling Annona in the form of fruit, a solid, spheroid syncarpium composed of one-ovuled carpels fused together, but differing from that genus in having its petals imbricate or overlapping and in the outer circles of its stamens which are sterile and petaloid.—A genus of very few species. *Fusæa longifolia* was first described as *Annona longifolia* by Aublet. It was afterwards placed in the genera Duguetia and Aberemoa, from the last-named of which it was set apart by Baillon as the type of a subgenus or section Fusæa. In the genera Duguetia and Aberemoa, however, the carpels are discrete, or separate, and not fused together; in the former the indumentum is usually stellate-pubescent or scurfy, and in the latter the carpels are not only quite distinct but are borne on short pedicels. From the structural features above mentioned, it is evident that it merits generic rank.

longifòlia, Safford (*Duguètia longifòlia*, Baill. *Annòna longifòlia*, Aubl.) PINACOUA. CARIB APPLE. Fig. 1612. A small tree: lvs. oblong-acuminate, mucronate and smooth: fls. issuing from near the base of small branchlets growing from the axils of the lf.-scars of the preceding year, the 2 series of petals much alike; outer stamens sterile and petaloid: fr. ovate-globose, resembling a solid ball, its surface reticulated with shallow impressed lines, nearly smooth, flesh-colored. Guiana.—According to Aublet, the fr. has a good flavor and is eaten with relish by the Garipon and Galiba (Carib) Indians of French Guiana. Intro. into Fla. as a fr.-plant, but very little known. Closely related to this species and possibly identical with it is the Peruvian *F. rhombipétala*, Safford (*Annòna rhombipétala*, Ruiz. & Pav.) with petals clothed on the outside with appressed sericeous hairs, outer stamens petaloid and connivent as in *F. longifolia*, ½in. long, smooth near the base and minutely puberulent on the outside near the apex; and obovate-oblong lvs. with short thick petioles and sharply acuminate apices, the midrib and lateral nerves impressed on the upper surface and prominent beneath, the extremities of the latter connected by a submarginal nerve almost continuous from the base to the apex.

W. E. SAFFORD.

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XLV. Ferns in a public garden, with springtime bloom.

G

GÀGEA (Sir Thomas Gage, British botanist, died 1820). *Liliàceæ.* Seventy-five or more small herbs of Eu., N. Afr. and east to China and Japan, allied to Ornithogalum, mostly hardy and sometimes grown in the open. Fls. white, yellow or rose, few on the top of the mostly low peduncle or scape: lvs. radical, mostly only 1, and sometimes on the st. and represented by bracts under the umbel: perianth persistent, with distinct segms.; stamens 6; ovary sessile or short-stipitate, 3-loculed: bulbs small. The gageas require the cult. of ornithogalums. They appear not to be in the American trade. **G. Liotárdii,** Schult. f., the gold-star, is from Eu. and eastward; a well-recommended alpine, 4–6 in. high, with yellow fls., making grassy mats: radical lf. usually 1, fistulose; scape-lvs. 2, one of them larger and at base convolute.—**G. lùtea,** Ker (*G. fasciculàris,* Salisb.), the yellow star-of-Bethlehem has yellow fls. with backs of segms. green, opening only in forenoon: radical lf. 1, linear, 6–18 in. long: scape short, with 1–3 bracts. Eu. to Himalayas. B.M. 1200. **G. bracteolàris,** Salisb. (*G. stenopétala,* Reichb.), is pale yellow: lf. 1 at base, linear-lanceolate and glaucous; st.-lvs. opposite, lanceolate, pubescent and fringed. Eu.

L. H. B.

GAILLÁRDIA (named for M. Gaillard, a patron of botany in France). *Compósitæ.* Showy annual and perennial herbs largely cultivated in borders and flower-gardens.

Leaves alternate, more or less toothed, and spotted: fls. in solitary and usually very showy heads, the rays yellow and red and always neutral, the disk-fls. purple and fertile; involucre broad, the bracts in 2 or 3 series, hairy; ligules 3-toothed or 3-cleft, giving a fringed appearance to the fls.—There are 12 species, all American, mostly from the far W.

There are two types of gaillardias,—the annual forms, which are derived from *G. pulchella* and *G. amblyodon,* chiefly from the former; and the perennials, which issue from *G. aristata.* The gaillardias are conspicuous for profusion and duration of flowers. A constant succession is produced all summer until very late into the autumn. Besides their use as border or bedding plants they are good for cut-flowers, as they last well in water. They thrive best in light, open, well-drained soil, and should have full sunlight and air. In heavy or wet soils the plants are often winterkilled. The perennial forms are propagated by division, seeds or cuttings in August or September; also by root-cuttings in early spring. They usually do not breed true from seed and as better plants are produced by cuttings it is the most satisfactory method of propagation. *G. grandiflora* and its many varieties are garden forms of *G. aristata* (see Gt. 49, p. 583. G. 7:499). Some of the more recent introductions have highly colored flowers of extraordinary size, at least 4 to 5 inches in diameter. Another kind has quilled florets (*G. fistulosa*) of which Buffalo Bill is an excellent example,—a large, pure yellow with a narrow disk. Vivian Grey is also a remarkable and most distinct form, with clear yellow fringed rays, and disk of the same color. More recent introductions include *G. kermesina splendens* with narrow canary-yellow rays and rich crimson disk, and *G. sulphurea oculata* with pale sulfur, and bright maroon disk-flowers. Other trade names referable to no botanical species are *G. hybrida grandiflora, G. Josephus, G. semiplena,* and *G. Loiselii* (=*picta Loiselii,* H.F. II. 8:329?).

1613. Gaillardia pulchella var. picta. (×⅓)

1614. Gaillardia pulchella, the form known as G. Lorenziana. (×½)

A. *Annual gaillardias: fls. normally mostly red.*

amblyodon, Gay. One to 2 ft., erect, leafy, hirsute: lvs. oblong or spatulate, sessile and auriculate, entire or nearly so: lobes (or teeth) of disk-corollas short and obtuse; rays numerous, brown-red or maroon throughout their length. Texas. F.S. 21:2149. —Somewhat cult. amongst garden annuals, and worthy.

pulchélla, Foug. Erect, branching, 12–20 in., soft-pubescent: lvs. oblong, lanceolate or spatulate, rather soft, nearly sessile, either entire or the lower ones lyrate-pinnatifid: lobes of disk-fls. acute or awned; heads 2 in. across, the flat rays yellow at top and rose-purple at base. Ark. and La. to Ariz. B.M. 1602; 3551 (as *G. bicolor*).

Var. **pícta,** Gray (*G. pícta,* Hort.). Fig. 1613. The common garden form under cult., having larger heads and of various colors. B.M. 3368. R.H. 1852:20. V. 16:181. In one form (*G. fistulòsa, G. tubulòsa, G. Lorenziàna,* Hort.), the ray-florets and sometimes the disk-florets are enlarged and tubular. Fig. 1614. R.H. 1881, p. 377; 1885:156.

AA. *Perennial gaillardias: fls. normally yellow.*

aristàta, Pursh (*G. grandiflòra, G. lùtea, G. máxima,* and *G. perénnis,* Hort.). Erect, 2–3 ft.: lvs. rather thick, lanceolate or oblong, sometimes spatulate, varying from entire to sinuate pinnatifid: lobes of disk-corollas acute or awned; heads 3–4 in. across, the flat rays yellow, or in cult. varying to red (particularly at the base). Plains W. B.M. 2940. B.R. 1186. Gng.

2:345. Gn. 45, p. 325. A.F. 5:329.—This is the common perennial gaillardia of gardens (cult. under many names). Blooms the first year from seed. From *G. pulchella* it is distinguished by taller growth, firmer lvs., yellower heads, and less attenuate lobes of the disk-fls.; but it is practically impossible to distinguish the two, except that one is annual and the other perennial.

N. TAYLOR.†

GALÁCTIA (from the Greek, *milk;* some species said to yield a milky juice, which is improbable). *Leguminòsæ.* Prostrate or twining, perennial herbs or shrubs, mostly of the warm regions of America, only seldom cultivated.

Plants usually with pinnately 3–9-foliate lvs., and axillary, interrupted racemes of perfect, more or less perigynous fls.: calyx short, 4-lobed, bracted; corolla papilionaceous; standard broad; stamens 10, diadelphous; ovary 1, superior, 1-celled, with many ovules; style beardless: fr. a linear, straight or slightly curved legume. Cleistogamous fls. sometimes produced.—There are many species, but of very little horticultural value. The two following have been advertised in the past but are probably not now on the market.

regulàris, BSP. (*G. glabélla,* Michx.). Lvs. with 3 lfts.: panicles mainly shorter than the lvs.: lfts. elliptical, often notched at the tip, 1–2 in. long, glabrous: corolla violet-purple. Dry sandy soil, N. Y. to Fla. and Miss. B.B. 2:335.

Élliottii, Nutt. Lvs. with 7–9 lfts.: panicles longer than the lvs.: lfts. elliptic-oblong, notched, pubescent beneath, ½–1¼ in. long: corolla white tinged with red. Dry sandy soil, S. C. to Fla., along the coast.

K. M. WIEGAND.

GALÁNTHUS (Greek, *milk flower*). *Amaryllidàceæ.* SNOWDROP. Spring-blooming bulbs (one autumnal), with solid scapes and solitary nodding white flowers.

Bulb tunicated, small: lvs. 2–3, strap-shaped: perianth without tube, outer and inner segms. unlike; stamens 6: fr. a 3-valved caps., more or less fleshy.—Probably a half-dozen species, in Eu. and W. Asia. The flowers of snowdrops (*G. nivalis,* Fig. 1615) are amongst the smallest and daintiest of common hardy cult. spring-blooming bulbs. They often bloom in early March, before all the snow has gone. Their pendulous white fls., with the "heart-shaped seal of green" dear to Rossetti, hold a unique place in the affections of lovers of gardens. At first sight the fls. seem to have 3 large white petals, inclosing a green-and-white tube with 6 tips, but a second glance shows that the parts that function as petals are the outer segms. of the perianth, while the 3 inner ones, with their 2-lobed tips, are not grown together, but overlap slightly, forming a rather crude but stiffish tube. Each plant has a globose coated bulb, 2–3 lvs., grows 6–9 in. high, and bears usually only 1 nodding fl., which emerges from a spathe. Behind the perianth is the globose green ovary.

1615. The snowdrop—Galanthus nivalis. (×½)

In a congenial spot, moist, cool and shady, the plants increase satisfactorily, and sometimes, without any care whatever, form a bed from which thousands of flowers may be picked at what is, perhaps, the most desolate and wearisome moment of the year. The leaves are linear and channeled, and in dark, shining masses make a rich, quiet effect. They come out with the flowers, attain their full growth later, and commonly die down in midsummer or fall. The bulbs are cheap, and should be ordered in liberal quantities. Plant in the autumn, as for other hardy bulbs; set 3 to 4 inches deep in mellow soil, and close together.

An era of new interest in snowdrops began about 1875, with the introduction of the "giant" kind (*G. Elwesii,* Fig. 1616), but those who do not care for "large violets" will be likely to cling to the small snowdrops. Nevertheless, *G. Elwesii* is very distinct, and should be the first choice if any large kinds are desired, and to secure the best forms the connoisseur should buy imported bulbs of its varieties. The only kinds known so far to possess a patch of green at the base of the inner segments are *G. Elwesii* and *G. Fosteri.* Considering that there are only two main types in this genus, *G. nivalis* and *G. Elwesii,* the profusion of Latin names (especially since 1888, the date of Baker's "Handbook of the Amaryllideæ") is rather trying, except to the connoisseur who, unlike the general public, is chiefly interested in the larger-flowered forms and the novelties.

There are several types of minor importance. The autumn-flowering kinds, representing many Latin names, as *G. octobrensis, G. corcyrensis, G. Reginæ-Olgæ,* are usually weak-growing plants. However, much is hoped from *G. cilicicus,* especially by the florists, who have hitherto found no snowdrop that could be profitably forced for Christmas. Doubleness seems to add nothing to the beauty of snowdrops. So far it seems to have affected only the inner segments of *G. nivalis* and *G. Elwesii.* Yellow snowdrops are also practically unknown in America. In these the heart-shaped spot and the ovary are yellow instead of green. Of these, *G. flavescens* is perhaps one of the best.

INDEX.

byzantinus, 12.
Cassaba, 5.
caucasicus, 4.
cilicicus, 2.
corcyrensis, 1.
Elwesii, 5.
Erithræ, 5.
flavescens, 1.
Fosteri, 9.
globosus, 5.
Gotwaldii, 12.
græcus, 6.
grandiflorus, 11.
Ikariæ, 8.
Imperati, 3.
latifolius, 7.
maximus, 4, 11.
nivalis, 1.
ochrospilus, 5.
octobrensis, 1.
octobrinus, 1.
plicatus, 10.
poculiformis, 5.
Redoutei, 4.
reflexus, 1.
robustus, 5.
Sharlockii, 1.
unguiculatus, 5.
Whittallii, 5.

A. *Lvs. merely channeled, not plaited.*

B. *Width of lvs. small, 3–4 lines.*

C. *Base of lvs. not very narrow.*

1. **nivàlis,** Linn. (*G. Shárlockii,* Hort.). COMMON SNOWDROP. Figs. 1615, 1616. Bulb 6–12 lines thick: basal sheath split down one side: lvs. linear, glaucous, finally 6–9 in. long: outer perianth-segms. oblong, 6–12 lines long; inner segms. green only at the sinus. Feb., March. Pyrenees to Caucasus. R.H. 1880, p. 148. G.M. 34:154. G.C. II. 11:237. Gt. 48, p. 232.—There are large-fld. and double forms. Var. **corcyrénsis** and others flower in Nov. G.W. 2, p. 250. At least 2 varieties have yellow instead of green markings. Var. **flavéscens,** S. Arn. The markings on the inner segms. of the perianth and on the ovary are yellow, and the sts. are more yellow than green. Useful for Alpine gardens. G. 31:149. Var. **reflèxus** has outer segms. reflexed. G.M. 34:155. Var. **octobrénsis** (var. *octobrìnus,* Voss. *G. octobrénsis,* Hort.). Albania. Known in cult. as a form blooming in England late in Oct.

CC. *Base of lvs. very narrow.*

2. **cilícicus,** Baker. Less robust than *G. Fosteri,* with much narrower lvs., which are narrowed gradually from the middle to a very narrow base. Green color as in *G. nivalis.* Bulb ½in. thick: lvs. whitish beneath:

outer segms. oblong, 9 lines long, 3–4 lines broad; stamens more than half as long as the inner segms. Mt. Taurus, in Cilicia, where it flowers Nov. to March. Intro. 1898. See G.C. III. 21:214. Pictured in G.C. III. 23:79. A.F. 13:1137. Gng. 6:244. F.E. 11:282. Gt. 48, p. 228. Gn. 73, p. 88.

BB. *Width of lvs. medium, 6–9 lines long.*

C. *Foliage moderately glaucous.*

D. *Outer segms. of perianth 12–15 lines long.*

3. **Imperàti,** Bertol. Lvs. broader than in *G. nivalis,* and fls. larger: outer corolla-segms. spatulate, 1–1¼ in. long. Naples and Genoa. This and *G. caucasicus* are regarded by Baker as subspecies of *G. nivalis.* G.C. II. 11:237. G.M. 34:155. Gn. 76, p. 119.

DD. *Outer segms. 9–12 lines long.*

4. **caucásicus,** Baker (*F. Redoùtei,* Rupr.). Lvs. finally 8–9 in. long, mostly 9 lines broad: outer perianth-segms. oblong-spatulate, with a very narrow claw; fls. later than *G. nivalis.* Caucasus. Van Tubergen seems to catalogue var. *máximus* of this species, but consult No. 11.

CC. *Foliage very glaucous.*

D. *Inner segms. with lobes rather spreading or crisped.*

5. **Élwesii,** Hook. GIANT SNOWDROP. Fig. 1616. Bulb larger and fls. more globose than in *G. nivalis:* outer segms. oblong-spatulate, 9–15 lines long, 6–9 lines broad; inner segms. green in the lower half and also around the sinus. Mountains of Asia Minor. B.M. 6166. R.H. 1880, p. 148. G.C. II. 11:236. G.M. 34:154. Gn. M. 2:117; 12:112.—The inner segms. are narrowed suddenly just below the apical lobes, which are square and much larger than in *G. Fosteri.* They also form a narrower tube than in any other species. Dealers have advertised vars. **Cassàba** (A. F. 3:471. C.L.A. 5:135. Gng. 5:180. Gt. 48, p. 225. Gn. 55, p. 206), **ochrospílus** (has pale yellow coloring on the inner segms.), **unguiculàtus** has a long claw at the tip of each outer segm. (G.C. III. 17:361), and **Erithræ.** Var. **globòsus** has almost globular fls., larger than in the type, and very broad lvs. Var. *Whittallii* (Gn. 57, p. 45; 59, p. 262) seems to belong here. Var. **poculifórmis,** a large and robust form with the inner and outer segms. both pure white. Perhaps not in Amer. and rare in England.—*G. robustus,* Hort., seems never to have been accounted for by Baker. It may perhaps be *G. Elwesii* var. *robustus* which is a trade name. It is broad-lvd. and glaucous.

DD. *Inner segms. with lobes not spreading or crisped.*

6. **grǽcus,** Orph. Very near *G. Elwesii,* but differing as above and in the smaller fls. and narrower outer segms., and the very limited distribution of the wild species. April. Chios.

BBB. *Width of lvs. greatest, 9–12 lines.*

C. *Green color only near the sinus.*

D. *Colored on both sides of the inner segms.*

7. **latifòlius,** Rupr. Bulb. 1 in. thick: lvs. lorate, bright green: outer segms. oblong-spatulate, 6–9 lines long; inner segms. green around the sinus, inside and out; anthers suddenly narrowed to a sharp point, while in *G. nivalis* and *G. Elwesii* they are gradually narrowed. Caucasus, where it flowers in May. G.C. II. 11:237; 15:404. Gt. 48, p. 229.

DD. *Colored on only one side.*

8. **Ikàriæ,** Baker. Resembles *G. Fosteri* in foliage, and *G. Elwesii* not in coloring but in the square, crisp lobes of the inner segms. which tend to recurve: outer segms. nearly 1 in. long; stamens rather shorter than the inner segms.; green color occupying half the outside of the inner segms. Island of Nikaria (the classical Ikaria). See G.C. III. 13:506. Gn. 52, p. 361; 49, p. 330. G. 30:153. G.M. 52:146.—Intro. 1893.

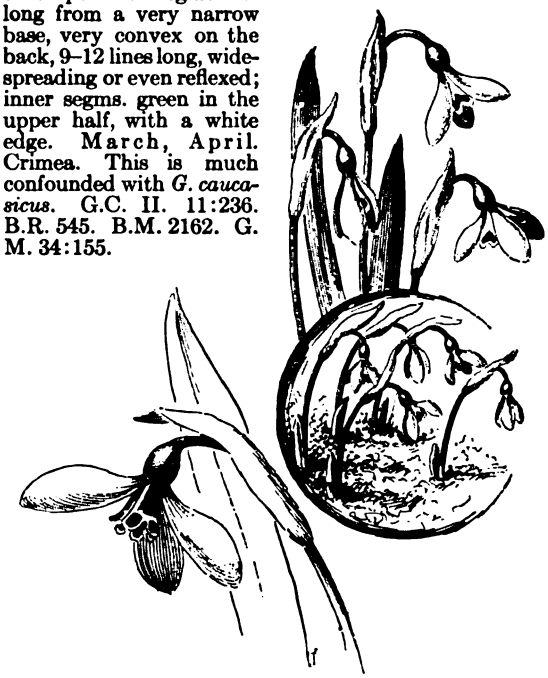
CC. *Green color also on the lower half of the inner segms.*

9. **Fósteri,** Baker. Resembles *G. latifolius* in foliage and *G. Elwesii* in fl., but the apical lobes of the inner segms. are short and erect, and smaller than in *G. Elwesii;* also the stamens are not more than half so long as the inner segms., while in *G. nivalis, G. Elwesii* and *G. latifolius* they are three-fourths as long. Asia Minor. Intro. 1889. G.M. 34:154. G. 35:193.

AA. *Lvs. plaited, the edges permanently rolled back.*

B. *Green color only near the sinus.*

10. **plicàtus,** Bieb. Bulb larger than in *G. nivalis:* lvs. about 12 in. long, and 1 in. wide, very glaucous: outer perianth-segms. oblong from a very narrow base, very convex on the back, 9–12 lines long, wide-spreading or even reflexed; inner segms. green in the upper half, with a white edge. March, April. Crimea. This is much confounded with *G. caucasicus.* G.C. II. 11:236. B.R. 545. B.M. 2162. G. M. 34:155.



1616. Galanthus nivalis and G. Elwesii. The upper flowers are G. nivalis; the lowest one is G. Elwesii; the middle flowers are a variety of G. Elwesii.

11. **grandifldrus,** Baker (*G. máximus,* Baker, not Velenovsky). Possibly a hybrid between *G. plicatus* and some form of *G. nivalis,* remarkable for its robust habit and green color, extending more than half way down toward the base of the inner segms. Intro. 1893. See G.C. III. 13:354, 656. See also *G. caucasicus* var. *maximus,* No. 4.

BB. *Green color also on the lower half of the inner segms.*

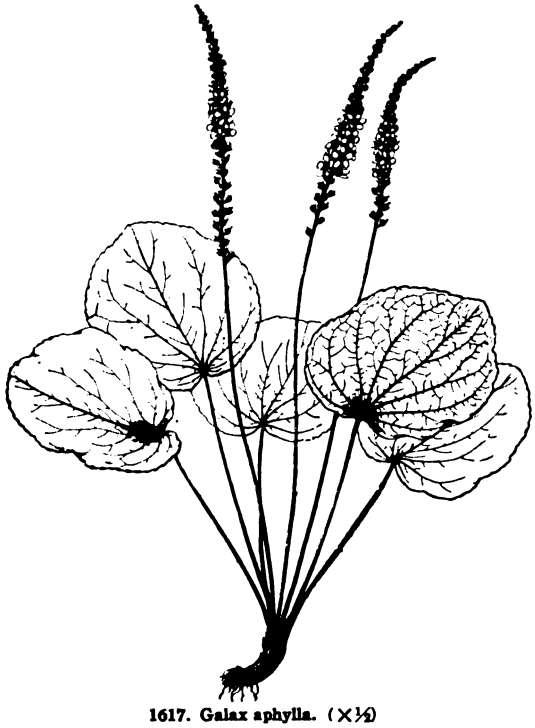
12. **byzantinus,** Baker (*G. Gótwaldii,* Hort.). Intermediate between *G. plicatus* and *G. Elwesii.* "Lvs. 3 in. broad," which seems hardly possible, glaucous on both sides, especially beneath; margins distinctly and permanently recurved: outer segms. oblong, convex on back, 9 lines long, 4 lines broad, apical lobes somewhat reflexed and crisped; stamens much shorter than inner segms. Intro. 1893. See G. C. III. 13:226.

G. Ällenii, Baker, has cone-shaped fls., pure white, but the petals "crimped into a distinctly large, horseshoe-like patch of green just below the wavy fold of the tips." Gn. 67, p. 53.—*G. Atkinsii,* Hort. Two plants seem to be cult. under this name, according to S. Arn., one a pure white one, the other frequently has an additional perianth-segm., also misshapen blooms. Both are scarcely known outside of England. Gn. 74, p. 154. By some supposed to be a form of G. nivalis.—*G. Olgæ,* Orph. Outer segms. about 1 in. long; inner ones half as long, plain white, with rounded lobes. Blooms in Oct. Greece.—*G. Reginæ-Olgæ,* Hort.=G. Olgæ.

WILHELM MILLER.
N. TAYLOR.†

GÀLAX (from the Greek meaning *milk;* application obscure). *Diapensiàceæ.* One acaulescent plant, much prized for its stiff bronzy root-leaves.

Calyx imbricated, persistent; petals 5, hypogynous, oblong-spatulate, entire, adnate to the base of the monadelphous stamens; the stamen-tube 10-toothed, the 5 teeth alternating with the petals antheriferous, the others petaloid; anthers transversely dehiscent; pistil 1; ovary superior, 3-celled, many-ovuled; style short: fr. a loculicidal, 3-valved caps.; seeds with a



1617. Galax aphylla. (×½)

loose cellular testa.—This genus contains but a single species. It belongs to a small family which was much more extensive in past geologic times, but is now on the way to extinction. A large industry has arisen in recent years consisting in the marketing of immense quantities of galax lvs. for decorative purposes, especially at Christmas time; but the lvs. are also used at other times in wreaths and bouquets. The bronzy autumn coloration of the lvs. adds to their attractiveness. They are collected in the mountains of N. C. and Va. The plants are grown also in rockeries. It is recommended to plant in rockeries with northern exposure, shade, and some moisture. Prop. by division.

aphýlla, Linn. (*Blandfòrdia cordàta,* Andr.). GALAX. Fig. 1617. Evergreen, perennial herbs: rootstock thick, matted, creeping: lvs. basal, tufted, round-heart-shaped, with narrow sinus, crenate, shining, conspicuously palmately netted-veined, 1–3 in. broad, on long slender petioles: scape 1–2½ ft. high; spike-like raceme dense, 2–5 in. long; fls. small, white, 1½–2 lines broad. In dry woods chiefly in the mountains, Va. to Ga., and along the coast, Va. to N. C. B.M. 754. G.F. 5:605 (adapted in Fig. 1617). G.M. 44:223. Gn. 59, p. 187.—Called also colts-foot or beetle-weed. K. M. WIEGAND.

Galax leaves were used for decorative purposes in a commercial way only as far back as 1890, when they were introduced to the northern florist trade by the writer, who had experimented with them for several years before that date, sending to hospitals and individuals. The reports received fully justified the introducer in advertising the leaf widely as a florist's decorative material for making up wreaths, crosses, and in fact all designs for which ivy leaves up to that time had been employed almost exclusively. Today galax leaves have to a great extent taken the place of ivy leaves, being less expensive, more easily handled and kept, and furnishing long wiry stems. The brilliant bronze leaves supply a color long needed in this class of work. The sizes also of the leaves vary from ½ inch or less to 5 inches diameter, again making their uses very varied. Small green galax leaves are now used extensively for bunching with violets, taking the place of the violet leaves. One of the features of the holiday season in Boston is the fakir with his stand of violets bunched with green galax. They come in again and are used the same way at the first touch of spring, when the early trailing arbutus or "mayflower" appears on the street. They can be arranged to cover much more space than the ivy leaves, and do not have to be wired, as is the case with the latter. The keeping qualities of galax are remarkable, and they are now used the year round from cold storage. Outdoor designs, as in cemeteries, will keep fresh and bright for months if not dried out, but otherwise require no care. A favorite arrangement of galax leaves is to place them loosely in a small vase, where they will retain their bright colors and shape for weeks, even in a close warm room, though most of the leaves are used, commonly with flowers, in designs made up by the florist. As a Christmas decoration they stand preëminent, and their general good qualities mentioned above cause them to be used throughout the year, more, perhaps, than any other decorative green, ferns possibly excepted.

In Philadelphia, some time ago, an enterprising young woman introduced a novel and taking innovation in the shape of potted galax plants for society dinners. Small, brilliantly colored green and bronze leaves were arranged in tiny pots, specially designed by Messrs. Sackett & Company, and placed at each plate, to be carried away by the guests as souvenirs. They were also sold through one of Philadelphia's leading merchants by thousands.

The larger cities, Boston, New York, Philadelphia and Chicago, use the largest quantities, though many of these are retailed again to smaller cities and towns all over the United States and Canada, and there is a large export trade now established in them, mostly to Germany and the Netherlands.

The area over which galax is collected extends from Virginia to Georgia, and is so vast that there is no danger of exterminating the plant by collecting the leaves, even if they were injured thereby, which does not seem to be the case. It is not practicable to grow the plants for the harvest of leaves, at least in America, the process being too expensive. Under cultivation they would perhaps not average one perfect salable leaf to a plant, as a speck or wormhole renders the leaf unfit for decorative purposes. In Europe galax has been tried with varying success under glass, the leaves bringing a very high price.

Galax aphylla is a beautiful ground-covering plant, specially adapted to the rhododendron border, where the soil and situation alike are suitable to its growth; it delights in shade and a cool, moist, peaty loam. Its charms are far better known in England, however, than at home. The leaves, when full grown, are always bright green, the brilliant bronze shades appearing later when the plant ripens and the frosts begin. Then when they are exposed to the direct rays of the sun the alternating freezing and sun action cause the leaves to turn in a short time, though sometimes this occurs to an extent before any freezing weather, when the sap starts downward. In dense shade they always remain green. In spring, when the sap begins to start, the leaves often turn green or dingy again, and eventually die down the second season. HARLAN P. KELSEY.

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GÁLBANUM: *Gums and Resins.*

GALEÁNDRA (Greek for *helmet* and *stamen*). *Orchidàceæ*, tribe *Vándeæ*. Deciduous epiphytes, to be grown under warmhouse conditions.

Plants with jointed thickened sts.: lvs. distichous, membranaceous: labellum infundibuliform; sepals and petals equal, spreading; column erect, winged; pollinia 2.—Six species in Trop. Amer. Cult. as for Eulophia.

Devoniàna, Lindl. St. erect: lvs. linear-lanceolate, sheathing at base: sepals and petals lanceolate, reddish brown, with green margins; labellum whitish, veined in front with crimson. From the banks of the Rio Negro. B.M. 4610. I.H. 21:176. A.F. 6:609. J.F. 2:195. V.O. 9:8.

Baûeri, Lindl. Sts. subcylindric, nearly fusiform: lvs. lanceolate: racemes terminal, drooping; fls. large; sepals and petals similar, lanceolate, yellowish; labellum pale yellow in the throat, interior portion purplish. Mex., S. B.R. 26:49. P.M. 14:49.

D'Escagnolleàna, Reichb. f. Sts. terete, tapering both ways: lvs. lanceolate, pointed: racemes terminal and drooping; sepals and petals similar, ascending, narrow, yellowish; lip funnelform or nearly bell-form, fluted, with a rose-purple blotch on the lower limb. Brazil. I.H. 34:22 (1887).

G. nivàlis, Mast. Racemes short, few-fld., fls. about 2 in. across; sepals and petals light olive-green, the funnel-like lip white with a purple blotch. Trop. Amer. V.O. 9:9. G.W. 14, p. 307.

OAKES AMES.
GEORGE V. NASH.†

GALEDÛPA: *Pongamia.*

GALÈGA (Greek, *gala*, milk: supposed to increase the flow of milk). *Leguminòsæ.* Bushy perennials not very commonly cultivated in America.

Of 120 names of species in this genus, only 6 are now retained, most of the others being referred to Tephrosia. The plants mentioned below are hardy herbaceous perennials of the easiest cult., about 3 ft. high, with odd-pinnate lvs. and pea-shaped fls. of purplish blue or white. They do not require frequent division, make bushy plants, and bear in July and Aug. many dense, axillary and terminal racemes of fls., which are useful for cutting. Seeds of goat's rue are still offered abroad among miscellaneous agricultural seeds, but the plants are little known in this country. They are native in S. Eu. and W. Asia.

A. *Lfts. lanceolate: stipules broadly lanceolate.*

officinàlis, Linn. GOAT'S RUE. Fig. 1618. Height 2–3 ft.: lfts. mucronate: fls. purplish blue. Eu., W. Asia. G.M. 49:57. Var. **álba** or **albiflòra** is commoner in cult. Gn. 50, p. 269. G.L. 22:294. J.H. III. 48:557. Var. **Hártlandii,** Hort., has large spikes of lilac fls. and the young foliage variegated. A.F. 22:695.—A rose-colored variety is sold as var. **cárnea,** Hort., which is also known in a double-fld. form; a dwarf, compact, lilac-fld. variety sold under the name var. **compácta,** is also known.

AA. *Lfts. lanceolate: stipules broadly ovate.*

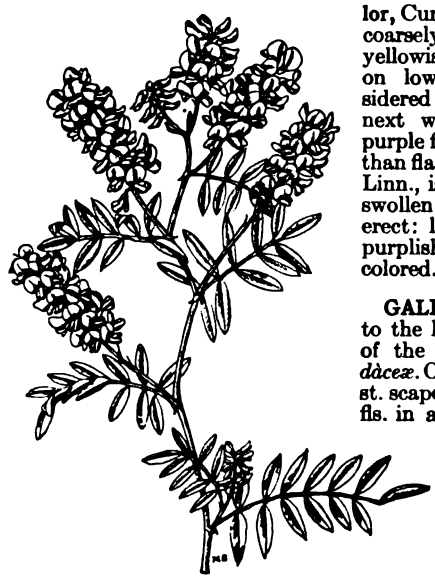
orientàlis, Lam. Foliage and stipules larger: fls. purplish blue, nodding: pods pendulous. Caucasus. B.M. 2192. Gn. W. 23:147. B.R. 326.—Height 2½–4 ft.: rootstock creeping: st. simple.

N. TAYLOR.†

GALEÓBDOLON: *Lamium.*

GALEÓPSIS (*weasel-like*, from some fancied resemblance). *Labiàtæ.* HEMP NETTLE. Several weedy European plants, some of them naturalized in this country, rarely cult. in gardens. Annuals, of spreading habit, opposite lvs. that are dentate or entire, and red, yellowish or variegated fls. in whorls toward the top of the st.: calyx with 5 nearly equal teeth; corolla widened in the throat, bearing an entire arched upper lip and a palate with 2 teeth. **G. Ládanum,** Linn., is canescent, with very narrow, nearly or quite entire lvs.: fls. rose-red or red, sometimes spotted yellow: 8–12 in.: there are forms with broader lvs. and also narrow lvs., and otherwise variable. **G. versícolor,** Curt., has hispid sts., ovate coarsely toothed lvs., and large yellowish fls. with purple spot on lower lip: by some considered to be a form of the next with larger yellow-and-purple fls. and an arched rather than flat upper lip. **G. Tetràhit,** Linn., is bristly-hairy with st. swollen beneath the joints, erect: lvs. ovate, toothed: fls. purplish or white or parti-colored.

L. H. B.



1618. Galega officinalis. (×⅓)

GALEÓRCHIS (in reference to the hood-like organ formed of the united sepals). *Orchidàceæ.* Orchids with fleshy roots: st. scape-like, with 2 basal lvs.: fls. in a short, loose spike, exceeded by the large bracts; sepals united, forming a hood; petals connivent; lip entire, spurred; column short; pollinia granulose, 1 mas in each sac, tailed.

spectábilis, Rydb. (*Orchis spectábilis,* Linn.). SHOWY ORCHIS. St. up to 1 ft. tall, 5-angled: spike 3–6-fld.; fls. violet-purple, variegated with lighter purple and white. N.E. N. Amer.

GEORGE V. NASH.

GÀLIUM (Galion was the name of a plant mentioned by Dioscorides as used in curdling milk. *G. verum* is locally used abroad for this purpose). *Rubidcæ.* BEDSTRAW or LADIES' BEDSTRAW, so-called because of the legend that one of these plants was in the hay on which the mother of Christ rested. Mostly weak or slender herbaceous plants with square, often barbed stems, and whorled leaves.

Flowers very small, perfect, epigynous; calyx almost or quite obsolete; corolla gamopetalous, rotate, deeply 4-parted; divisions in our species acute or acuminate; stamens 4; ovary inferior, 2-celled, forming a 2-lobed, 2-seeded, dry, indehiscent fr.; the lobes nearly globular. —About 220 species in various parts of the world. Noted for the recurved-scabrous sts. of many species, mathematical habit due to the whorled lvs., and the fine fluffy fls. The profuse-flowering species noted below are often used in rockeries and flower-beds for the regular but soft and filmy effect, which is similar to that of gypsophila. As cut-fls., they are used to lighten the effect of heavier fls.

A. *Fls. yellow.*

vèrum, Linn. YELLOW BEDSTRAW. Perennial from a somewhat woody base: sts. erect, smooth, tufted, 1–3 ft. high: lvs. in 8's or 6's, linear, ½–1 in. long; apex bristle-tipped: panicle ample, its lower branches exceeding the lvs. Eu., now also a weed in fields in the E. U. S.—A very good plant for rockeries and banks.

AA. *Fls. white.*

B. *Lvs. in 4's, lanceolate, several-nerved.*

boreàle, Linn. NORTHERN BEDSTRAW. Perennial, stoloniferous, forming patches: sts. smooth, 1–3 ft.

high, erect, strict: lvs. ¾–1½ in. long; apex not bristle-tipped: panicle ample: fr. usually minutely bristly. Rocky soil, Que. to Alaska and south to Pa. and Colo.—Useful in rockeries and flower-beds.

BB. *Lvs. in 8's or 6's, oblanceolate to linear.*

Mollùgo, Linn. WILD MADDER. WHITE or GREAT HEDGE BEDSTRAW. Perennial, smooth: sts. erect or diffuse, 1–3 ft. high, mostly in clumps: lvs. ½–1 in. long, bristle-tipped, 1-nerved: panicle ample: fr. smooth. Eu., but a weed in fields in the eastern states.—This plant is known in some places as "baby's breath," but this name is properly given to gypsophila.

K. M. WIEGAND.

GALPHÌMIA (anagram of Malpighia). *Malpighiàceæ.* Woody plants, sparingly introduced in Florida and southern California.

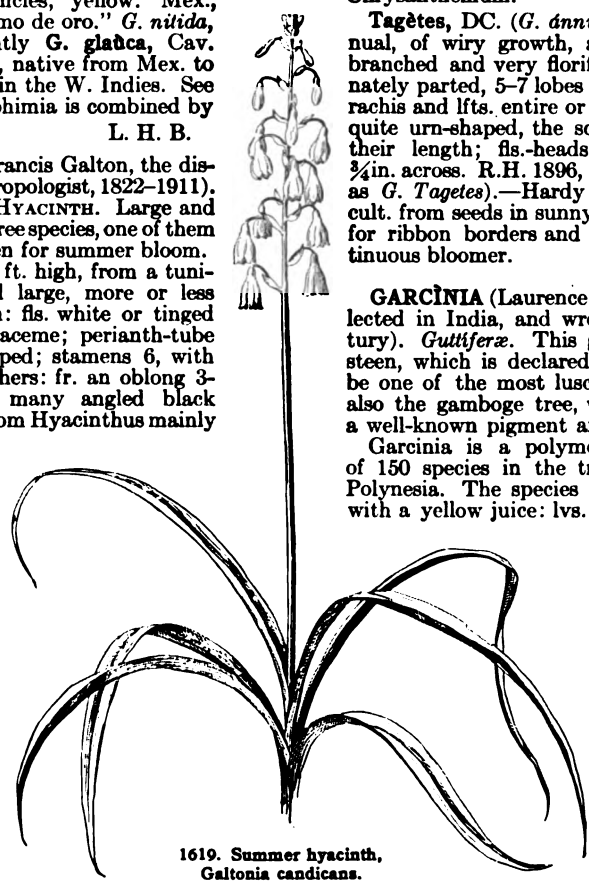
Shrubs or subshrubs: lvs. opposite, small, slightly glaucous on both sides or beneath, entire or obscurely toothed, glandular at the margin or base of blade or at the tip of the lf.-stalk: clusters terminal; fls. yellow or reddish; calyx without glands; petals toothed, clawed, spreading: fr. a 3-parted caps., not winged.—Species 15 or more, from S. Texas to Brazil, largely Mexican. Little known as cult. plants, although a few species have been mentioned in hort. literature abroad, and the two following are listed in Calif. **G. brasiliénsis,** A. Juss. Shrub: lvs. ovate or lanceolate, about 1 in. long, reddish, glabrous, glaucous beneath: fls. small, yellow, in short lax panicles, said to be bright in winter in Calif.; pedicels jointed at base; petals ovate-lanceolate, obtuse, scarcely twice longer than calyx. Brazil. **G. hirsùta,** Cav. Shrub: lvs. bright green, ovate, acute, twice larger than in preceding, hairy both sides: fls. larger, in longer panicles, yellow. Mex., where it is known as "ramo de oro." *G. nítida,* cult. in Fla., is apparently **G. glaùca,** Cav. (*Thryàllis glaùca,* Kuntze), native from Mex. to Panama and naturalized in the W. Indies. See *Thryallis,* with which Galphimia is combined by recent students.

L. H. B.

GALTÒNIA (after Sir Francis Galton, the distinguished author and anthropologist, 1822–1911). *Liliàceæ.* GIANT SUMMER HYACINTH. Large and handsome Cape bulbs, of three species, one of them being cultivated in the open for summer bloom.

Scape or peduncle, 2–4 ft. high, from a tunicated bulb: lvs. long and large, more or less fleshy, all from the crown: fls. white or tinged green, large, in an open raceme; perianth-tube short, oblong or club-shaped; stamens 6, with linear-oblong versatile anthers: fr. an oblong 3-valved caps., containing many angled black seeds.—The genus differs from Hyacinthus mainly by its more numerous and flattened crowded seeds. The other 2 species are inferior to the following, which was intro. by Leichtlin in the early seventies of last century, and now holds a permanent place in horticulture. The plants prefer a rich, open, moist soil.

cándicans, Decne. (*Hyacinthus cándicans,* Baker). Fig. 1619. Bulb large, round, coated: lvs. 4–6, lorate-lanceolate, 2½ ft. long: scape often 4 ft. high; racemes 20–30-fld.; fls. fragrant, pure white, 1–1½ in. long, the tube oblong; stamens about ½in. long, inserted high in the tube. F.S. 21:2173. G.C. 1871:380, desc.; 1872:1099; II. 15:273. G. 28:687. Gn. 62, p. 361; 64, p. 158; 69, p. 163. J.H. III. 45:262; 47:583. R.H. 1882, p. 32. P.G. 3:101. A.G. 17:281. —The plants should be heavily mulched if left outdoors where winters are severe. In favored localities the bulbs may be left for several years with increasingly better results. Large clumps are desirable.



1619. Summer hyacinth, Galtonia candicans.

G. clavàta, Baker. Bulb ovoid, 3–4 in. diam.: lvs. 6–8, soft, 2–2½ ft. long, with whitish margin: scape 2 ft., bearing a lax raceme: fls. with a clavate tube which is 1 in. long and which is twice as long as the segms. B.M. 6885.—*G. princeps,* Decne. Much like G. candicans, but fls. fewer and raceme shorter: stamens inserted below middle of tube.

L. H. B.†

GAMÓGYNE (name refers to the united ovaries). *Aràceæ.* Two erect small herbs from the Malaysian region, bearing attractive colored inclined spathes: lvs. narrow, thickish, tapering into petiole: spadix included in the spathe: fls. apetalous; anthers truncate; ovaries united. *G. púlchra,* N. E. Br. Peduncles erect, terete, reddish brown, about 6 in. long: spathe bright crimson, about 1¾ in. long, spreading or almost nodding, closed except at top: stigmas red: spadix with neuter organs at base. B.M. 8330. *G. Búrbidgei,* N. E. Br. Spathe less brightly colored: stigmas greenish yellow: spadix with neuter organs between the male and female parts.

GAMÓLEPIS (Greek for *united scales;* referring to the involucre). *Compósitæ.* Flower-garden plants.

Leaves alternate and mostly pinnatisect: peduncles 1-headed, the heads bearing 1 series of yellow, pistillate rays, the disk-fls. perfect: achenes without pappus, wingless and glabrous.—About a dozen S. African herbs or small shrubs, somewhat allied botanically to Chrysanthemum.

Tagètes, DC. (*G. ánnua,* Less.). Fig. 1620. Annual, of wiry growth, a foot or less high, much branched and very floriferous: lvs. pinnate or pinnately parted, 5–7 lobes or lfts. on either side of the rachis and lfts. entire or lobed: involucre nearly or quite urn-shaped, the scales joined more than half their length; fls.-heads bright yellow or orange, ¾in. across. R.H. 1896, p. 412. Gn. 25, p. 407 (both as *G. Tagetes*).—Hardy or half-hardy. Of easiest cult. from seeds in sunny places, and most excellent for ribbon borders and for low mass effects. Continuous bloomer.

L. H. B.

GARCÌNIA (Laurence Garcin, who lived and collected in India, and wrote in the eighteenth century). *Guttíferæ.* This genus includes the mangosteen, which is declared by some connoisseurs to be one of the most luscious of all tropical fruits; also the gamboge tree, whose resinous juice yields a well-known pigment and purgative.

Garcinia is a polymorphous genus of upward of 150 species in the tropics of Asia, Africa and Polynesia. The species are glabrous trees, usually with a yellow juice: lvs. evergreen, opposite or ternate, simple, often thick: fls. solitary or fascicled, polygamous or dicœcious; sepals and petals 4; stamens in male fl. many, 2- or 3-delphous; female fls. with staminodia; ovary 2- to many-celled, with sessile stigma and solitary ovule in each cell.—The mangosteen is cultivated in the West Indies; the gamboge tree is also cult. in S. Fla.; it is a broad-leaved tree of slow growth. The mangosteen is about the size and shape of an

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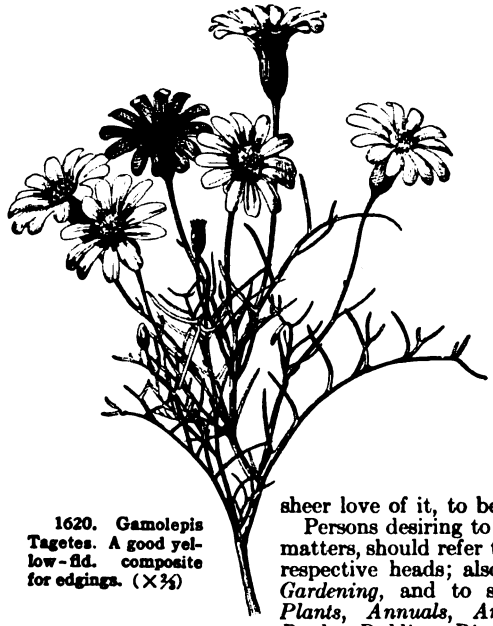
orange, with a rind of similar thickness and edible segments of form and arrangement like those of an orange. It is brilliantly colored outside with rich purple. The flavor is said to suggest something between a grape and a peach. Numberless efforts are said to have been made to naturalize this tree in the tropics without success. The successful ripening of this fruit under glass may be regarded as an achievement. See *Mangosteen*.

Mangostàna, Linn. MANGOSTEEN. Height 20–30 ft.: lvs. 7–10 in. long, elliptic-oblong, acuminate, leathery, nerves horizontal and very numerous: fls. (male) 1½ in. diam., purple or yellow-red, in few-fld. terminal fascicles; sepals orbicular, and petals broad-ovate and fleshy: fr. about 2½ in. diam., dark purple with large flat seeds. Malay region. B.M. 4847. L. B.C. 9:845. F.S. 22:2359. G.C. II. 4:657. G.W. 3, p. 8.

Morélla, Desr. GAMBOGE TREE. Height 30–50 ft.: lvs. more tapering at both ends, 4–6 in. long, the veins indistinct: fls. yellowish, male fls. about 3 in the axils, the sepals very small; female fls. larger, solitary, the staminodes about 12: fr. resembling a Morello cherry in size, slightly 4-lobed. Bengal to Siam.

L. H. B.†



1620. Gamolepis Tagetes. A good yellow-fld. composite for edgings. (×⅓)

GARDEN and GARDENING. The word garden etymologically means an inclosed space, and gardening is historically distinguished from agriculture by being within an inclosure of some kind instead of in the open fields. Gardening operations are usually conducted on a smaller scale than those of agriculture and by more intensive methods. Gardening and horticulture are really synonymous terms, but, by usage, a horticulturist is supposed to have a more extended training and wider range of activities than a gardener. Moreover, the word gardening now suggests more of the private, homelike and personal point of view, whereas the most distinctive feature of American horticulture is the immense commercial importance of fruit-growing on a large scale, and a marked emphasis of the professional side of a fruit-grower's work; and in later years, it is marked also by the very extensive vegetable-gardening and floricultural development. The history and discussion of gardening are, therefore, set forth in this book under *Horticulture*. Large private places are often divided into fruit-garden, kitchen-garden and flower-garden. Fruit-growing (which see) is the same as pomology. Kitchen-gardening, in its widest sense, is the same as vegetable-gardening (which see), or the more learned word, olericulture; but the expression kitchen-gardening is now less common, and usually indicates the private and uncommercial point of view, whereas market-gardening and truck-gardening (which are practically the same) are now the chief words used for the wholesale and commercial side of vegetable-gardening in the United States. Flower-gardening, a third primary division of gardening, is the same as floriculture (which see). Under ornamental gardening and landscape gardening are explained the two different points of view in the use of plants and flowers for their own separate values or when grouped for artistic effects, the nature-like or picturesque conception being set forth under landscape gardening, and the artificial or merely decorative styles under ornamental gardening.

It is customary to speak of gardening as the amateur and personal practice of horticulture. One makes a garden. One derives from the garden not only the plants and products that may be harvested, but also the satisfactions in plant-growing, the reaction to forms, fragrances and colors, and the gain of close contact with the out-of-doors. The first garden that one may have should be personal, for his own growth and development. Naturally, this will be in some personal or retired part of the grounds. In recent years, however, there has been a marked socialization of gardening, making it a contribution to public cleanliness and beauty and a means of educating the people. In America, this application of the gardening spirit to civic improvement has been very marked, as evidenced in the taking away of fences between adjoining properties and the development of a street as a unit. This is a great gain to public spirit and to social feeling; but this in no way interferes with the personal garden for the sheer love of it, to be grown in a place all one's own.

Persons desiring to find advice on specific gardening matters, should refer to the different genera under their respective heads; also to the articles under *Landscape Gardening*, and to such cultural entries as *Alpine Plants, Annuals, Arboriculture, Autumn Gardening, Banks, Bedding, Biennials, Border, Bulbs, Evergreens, Ferns, Herbary, House-plants, Orchids, Palms, Perennials, Rock-Gardening, Shrubbery, Spring-Gardening, Subtropical Gardening, Succulents, Vegetable-Gardening, Wall-Gardening, Water-Gardening, Kitchen-Garden, Wild-Garden*, and others.

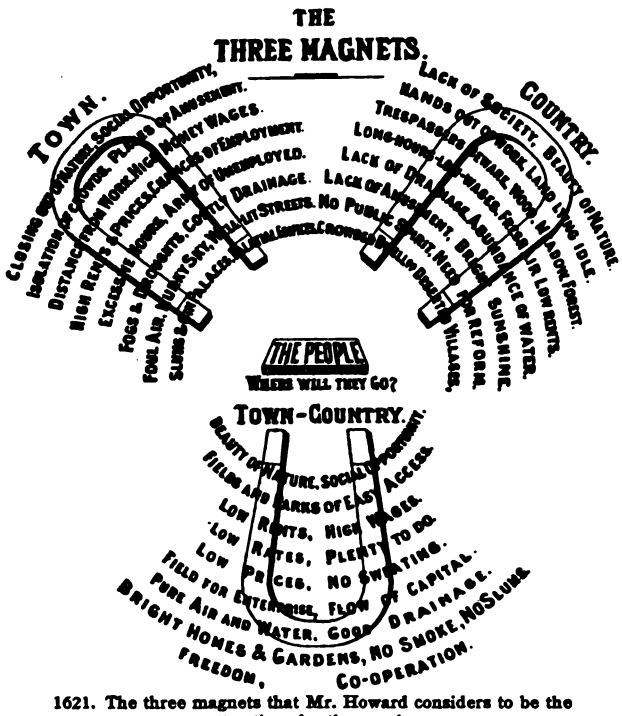
L. H. B.

GARDEN CITIES. Instead of being a community in which gardens are the dominant feature, the garden-city form of urban dwelling-place implies primarily an industrial town of limited size and of definitely advanced economic ideals. While there were in England, where the idea originated, several prior developments, the example which has best typified the aims and practicability of the garden city is that sometimes known as Letchworth, but actually named Garden City, in Hertfordshire, about thirty-five miles from London. The genesis of this enterprise appears to have been in the reception given to a little book entitled "To-morrow: A Peaceful Path to Real Reform," issued in 1898, and written by Ebenezer Howard, then a London stenographer. The stated purpose was "to organize a migratory movement of population from our over-crowded centers to sparsely settled rural communities." In detail, Howard proposed "to find for our industrial population work at wages of higher purchasing power, and to secure healthier surroundings and more regular employment. To enterprising manufacturies, coöperative societies, architects, engineers, builders and mechanicians of all kinds, as well as to many engaged in various professions, it is intended to offer a means of securing new and better employment for their capital and talents, while to agriculturists it is designed to open a new market for their produce close to their doors. Its object is, in short, to raise the standard of health and comfort of all true workers of whatever grade, the means by which these objects are to be achieved being a healthy, natural and economic combination of town and country life, and this

on land owned by the municipality." It will be observed that this is not a proprietory enterprise.

Howard considered that people aggregated themselves into the cities because of the "attractions" there, of various kinds. In the nature of the case, certain magnets attract to the town or city, and certain other magnets attract to the country. He would combine these magnets into a town-country habitation. He expressed the idea in a chart, Fig. 1621.

The reception given to this idea was so favorable that in 1902 a corporation was organized "to promote and further the distribution of the industrial population upon the land upon the lines suggested in Ebenezer Howard's book," which in 1904 began operations. It is interesting to note that among the subscribers to this company's stock were George Cadbury and Sir



1621. The three magnets that Mr. Howard considers to be the attractions for the people.

W. H. Lever, both of whom had previously established with success industrial villages upon a proprietary plan—Bournville and Port Sunlight.

While it is not the province of this sketch to discuss in detail the sociological features either of Garden City in England, or of its German prototype at Hellerau, near to and dependent upon the great German enterprise of the Krupps at Essen, it is proper to report the steady growth of the Letchworth scheme (so called because of the name of the largest estate purchased for establishing the Garden City), and to note the removal thither of several large industries, of which it is said that "printing, book-binding and various branches of engineering are the chief industries, and there are at least a dozen others." Garden City had, in 1912, eight years from its beginning, a population of 7,912, scattered comfortably and working happily in 1,761 buildings in the developed part of its 4,500 acres, and the effect of living eight years in its designed wholesomeness had been to give it a death rate of eight in the thousand, as compared with 14.1 for the larger English communities from which it drew its inhabitants and its industries. It is quite within the scope of this book to register the sober conclusion of the Royal Commission on Canals and Inland Navigation (England), in 1909, that "If industries are widely distributed, workers can have better houses at lower rents, can breathe less vitiated air, and they and their families can in many cases combine with factory work the healthy and profitable work of small agricultural production."

"The gardens of Garden City are . . . the small individual gardens of its houses and cottages. . . . The garden is inevitable in Garden City. . . . You will not find a house without one—a real practical garden. . . . The majority keep their gardens well. . . . Most of the residences are detached, with gardens all around them." Such are comments on this feature of the successful Garden City found in a book on the enterprise, itself an evidence of the quality of the printing product of the community. (The Garden City, by C. B. Purdom; "printed in the Garden City at the Temple Press and published by J. M. Dent & Sons, Ltd., London, 1913.")

In addition to the prevalence of gardens, this industrial community enjoys other features not usual in hit-or-miss development. The houses in Garden City are not in blocks or "rows," are not monotonously similar, include careful provision for health and cleanliness, and range in cost from $1,000 to more than $10,000. There are many outdoor recreational facilities, and a strong community spirit helps to provide entertainment and amusement. The town plan takes account of the contour of the land, and the houses of whatever character are touched or approached by the green of vine or tree or plant.

In the United States there are as yet no garden cities so thoughtfully designed and so capably worked out. There is a "Garden City" near New York, but it is merely a well-handled real estate promotion enterprise. Pullman near Chicago, was an attempt at mitigating the rigors of the congested city, and Gary, in Indiana, is a later and slightly more advanced industrial town. Neither approximates the efficiency of the English example. There are building in northern Michigan several industrial towns in which there is both planting and the retention of some native growth, but these are proprietary enterprises, and not coöperative as is the Letchworth Garden City.

It is certain that there will come into existence many more communities of the type of Garden City, because it is coming to be generally known that the influences of the garden and of wider living areas upon an industrial population are economically favorable and tend to contentment, permanence and prosperity, especially if intoxicating liquors are either kept out or are made available only under sharp restraint.

J. HORACE MCFARLAND.

GARDÈNIA (after Alexander Garden, M.D., of Charleston, S. C., a correspondent of Linnæus). *Rubiàceæ*. Shrubs or rarely small trees, sometimes nearly or quite evergreen, some of which are planted South and one yields popular flowers for cutting.

Plants glabrous or pubescent or even tomentose: lvs. opposite or in 3's, with interpetiolar stipules: fls. large, axillary and solitary or sometimes corymbose, yellow or white; calyx-tube ovoid or obconic; corolla salver-shaped or tubular, the tube much exceeding the calyx, the limb with 5–9 spreading or recurved contorted lobes; stamens 5–9, on the corolla-throat.—Species about 60, in subtropical regions of the eastern hemisphere. See *Randia* for related plants.

Gardenia includes the Cape jasmine, a tender shrub 2 to 6 feet high, with thick, evergreen foliage and large double, waxy camellia-like, fragrant flowers. It

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XLVI. Type of an old-time formal garden.—Washington's garden at Mt. Vernon.

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blooms from May to September in the South, where it is often used for hedges, and is hardy as far north as Virginia. In the middle of last century the Cape jasmine was considered one of the finest stove shrubs in cultivation, but with the waning popularity of camellias the doom of the Cape jasmine as a conservatory plant was sealed. The camellia has a greater range of color, and has had hundreds of varieties, while its scented rival has had barely a dozen. The flowers of the Cape jasmine have never been so perfectly regular as those of a camellia, and the plants are very subject to insect enemies. Their bloom is successional rather than close, and large plants are therefore not so showy as camellias. They are considerably grown abroad for cut-flowers in early spring, young plants a season or two old being used for best results. The variety with variegated foliage is dwarfer and weaker-growing. The true botanical name of the Cape jasmine is *G. jasminoides*, a name almost never used in the trade. "Cape jasmine" itself is one of the most remarkable cases of the vitality of an erroneous popular name. The single-flowered form was introduced much later than the double, and has always been less popular. The earliest picture of a living plant with single flowers was published in 1820 in B. R. 449. Cape jasmines are also handled by importers of Japanese plants, who sometimes offer seeds also. *G. lucida* was probably introduced by Reasoner, and *G. Rothmannia* by Franceschi, who reports that it is probably not now (1914) in cultivation. For the true jasmines (which belong to the olive family, and are often trailing plants), see *Jasminum*.

Culture.—The Cape jasmine of today, *Gardenia Veitchii*, was introduced by the well-known English firm of Jas. Veitch & Son. This new variety has fulfilled the long-desired want, because it is really a winter-flowering variety, while the old species *Gardenia jasminoides* or *G. florida* could not be made to flower during the early and midwinter when actually most valuable, hence the almost total abandonment of that old variety for cut-flower purposes. This new type has become one of the most popular florist flowers, although it is one of the most difficult plants to handle. The young plants are raised from cuttings in the early winter. Care must be taken to propagate only from thoroughly healthy plants. Three- to four-eye cuttings should be put into clean, sharp sand with a minimum bottom heat of 70° and a maximum of 85°. The atmosphere should be rather close in the propagating-house until after the cuttings begin to root, then some air should be admitted. The cutting-bench must be kept shaded from the sun and frequent syringing is absolutely necessary. When fully rooted in the sand, they are potted into 2-inch pots in well-prepared soil of four parts decomposed sod loam, one part of well-rotted old cow-manure and one part sand. The soil should be well screened. Potting firmly is essential, and not too much room should be left for water. A gentle bottom heat for these young plants is highly beneficial. When the sun begins to get higher and the days lengthen, a little fresh air during the middle of the day is invigorating for the young plants, but the night temperature should never go below 65°. The plants must be kept growing constantly and should be repotted as soon as they have filled their pots with roots. The months of May and June are the best time to plant gardenias into benches or solid beds. The best soil has been found to be well-rotted turf or sod, a pliable loam and well-rotted cow-manure well mixed, three parts of loam to one of manure. Should the soil be rather stiff or of a heavy texture, a portion of sand may be added. The benches should be 4 to 5 inches deep and have sufficient openings or cracks for drainage. Where very thin turf or sod can be had, the bench should be lined with this, or if not practicable, then a layer of sphagnum moss so as to cover the bottom of the bench. On top of this, a liberal sprinkling of pieces of charcoal will tend to keep the soil sweet. A small quantity of ground bone may be sprinkled over the soil after it is all spread on the benches ready for planting. Care must be taken that all balls are well softened and dissolved when planting so that there will be an amalgamation of the new soil and the soil of the ball. Firm planting and immediate watering are of the highest importance and frequent syringing after planting. Shading is not necessary, providing frequent syringing is given. Keep the soil moist but never wet. It is well to keep the house rather close for a few days, after which air can be given freely. *Gardenia Veitchii* can stand any amount of heat, and there is no danger of burning or scorching until the foliage begins to get warm. When thermometer goes above 90° to 95° more air must be given. The plants must now make their growth and if buds appear they must be pinched out. Keep pinching out buds and small side shoots until the latter part of September when buds may be allowed to set upon the stronger shoots. A strong healthy plant can carry four to six such flowering shoots. After buds begin to set and sometimes even before, bottom shoots begin to come. These are the second growth and make for a second crop of flowers as well as for propagating the young plants for the next season. Plants are seldom kept over the second year although it can be done successfully. Young plants are decidedly the most profitable. When the plants are well set with buds, in October and November, and the roots appear on the surface, a very light mulch of cow-manure is beneficial as it will assist to develop the flowers. A night temperature of 65° to 68° is best, while during the day it may range from 70° to 90°. Good hard syringing will keep down the pests which are fond of this plant, especially the mealy-bug. The flowers should be cut before the center petals have fully expanded and the longer the stem the more valuable the flower. (H. A. Siebrecht.)

A. *Corolla-tube cylindrical.*

B. *Calyx with 5 long teeth.*

C. *Ribs on the calyx.*

jasminoides, Ellis (*G. florida*, Linn. *G. radicans*, Thunb.). CAPE JASMINE. Variable, very small shrub, unarmed, the st. sometimes rooting: lvs. lanceolate, sometimes variegated: fls. white, solitary, very fragrant, waxy. For pictures of double forms, see B.M. 1842 and 2627, and B.R. 73; single, B.R. 449 and B.M. 3349; normal and variegated foliage, R.H. 1864, p. 30. China. Var. **Fortuniana,** Lindl. (*G. Fortunei*, Hort.). B.R. 32:43. F.S. 2:177. R.B. 23:241. In 1893 was advertised *G. camelliæflora* in addition to *G. radicans*, *G. florida* and vars. *major* and *majestica*. *G. sinensis grandiflora* of Berger's catalogue perhaps belongs here. Presumably the *G. Veitchii* of the gardens belongs here.

CC. *Ribs not present.*

lucida, Roxbg. Buds resinous: lvs. oblong; stipules annular, variously divided at the mouth, unequally lobed: fls. stalked, fragrant, white but ultimately turning yellow, 1–2½ in. across. India, Burma, Luzon. —The calyx-teeth are not decurrent, as in the Cape jasmine, and thus the calyx does not have the ribbed look.

BB. *Calyx tubular, with 5 very short teeth.*

amœna, Sims. Differs from all here described in having numerous strong spines nearly ½in. long, which are axillary: lvs. oval, acute, short-stalked: fls. subterminal; corolla-tube 1 in. long, longer than the lobes, which are 6, obovate, white, with margins incurved enough to show the rosy back. India or China.

BBB. *Calyx spathe-like.*

Thunbergia, Linn. f. Lvs. broadly elliptic, acute, with pairs of glands along the midribs: fls. 3 in. across,

pure white; corolla-lobes 8, overlapping. S. Afr. B.M. 1004.—Dwarf-growing, and perhaps not now in cult. in this country.

AA. *Corolla-tube short and wide-throated.*

B. *Fls. 3 in. long and broad.*

Rothmánnia, Linn. f. Very distinct in foliage and fl.: lvs. with pairs of hairy glands along the midrib: calyx ribbed, with 5 long teeth, equaling the short, cylindrical portion of the corolla-tube; corolla-tube rather suddenly swelled, ribbed; lobes 5, long-acuminate, whitish, spotted purple in the mouth. S. Afr. B.M. 690. L.B.C. 11:1053.—Fls. pale yellow, but it does not bloom in Calif. according to Franceschi.

BB. *Fls. 1½ in. long and broad.*

globòsa, Hochst. Lvs. oblong, short-acuminate; lf.-stalk nearly 3–5 lines long: fls. white, inside hairy and lined pale yellow; calyx small, with 5 very short teeth; corolla-tube wide at the base and gradually swelled; lobes 5, short-acuminate. S. Afr. B.M. 4791. F.S. 9:951.

G. citriodòra, Hook.=Mitriostigma axillare.—*G. intermèdia*, Hort., is a name unknown in botanical literature and the plant's affinities are unknown.—*G. Stanleyàna*, Hook.=Randia maculata.

WILHELM MILLER.
N. TAYLOR.†

GARDEN LEMON: *Cucumis Melo.*

GARDÒQUIA BETONICOÌDES: *Cedronella mexicana.*

GARGET: *Phytolacca decandra.*

GARLAND FLOWER in the South sometimes means *Hedychium coronarium.* Often means *Daphne Cneorum.*

GARLIC (*Àllium sativum*, Linn.). Hardy perennial bulbous plant, closely allied to the onion. It is native of southern Europe. It has flat leaves, and the bulb is composed of several separable parts or bulbels, called cloves. These cloves are planted, as are onion sets, in spring or in fall in the South. They mature in summer and early autumn, being ready to gather when the leaves die away. If the soil is rich, it may be necessary to break over the tops to prevent too much top growth and to make the bulbs better, as is sometimes done with onions. This is done when the top growth has reached normal full size. The cloves are usually set 4 to 6 inches apart in drills or rows, in ordinary garden soil. The bulbs are used in cookery, but mostly amongst the foreign population. Strings of bulbs braided together by their tops are common in metropolitan markets (Fig. 1622). The bulbs are white-skinned or sometimes rose-tinged.

L. H. B.

1622. Garlic, as strung for market.

GARLIC PEAR: *Cratæva.*

GÁRRYA (after Nicholas Garry, secretary of the Hudson Bay Company). Including *Fadyénia. Garryàceæ*, formerly included under *Cornàceæ.* Ornamental shrubs chiefly grown for foliage and showy catkins.

Evergreen: lvs. opposite, short-petioled, entire or denticulate, without stipules: fls. dicœcious, apetalous, 1–3 in the axils of opposite bracts on elongated, often drooping, axillary spikes; staminate fls. with 4 sepals and 4 stamens; pistillate with 2 sepals and 2 styles and a 1-celled ovary: berry 1–2-seeded, rather dry.—About 10 species in W. N. Amer. from S. Ore. to S. Mex., east to W. Texas.

The garryas generally have elliptic to oblong leaves, and small greenish white or yellowish flowers in catkin-like, often pendulous spikes, and dark purple or dark blue berries. None of the species is hardy North but *G. flavescens*, *G. Wrightii*, and also *G. Fremontii*, which are the hardiest, can probably be grown north to New York in sheltered positions, while the others are hardy in warmer regions only. They are well adapted for evergreen shrubberies, and the staminate plants are especially decorative in early spring with the showy, pendulous catkins, which in *G. elliptica* attain to 1 foot in length and often bloom in midwinter. The garryas thrive well in a well-drained soil and in sunny, sheltered position; in England they are often grown on walls. Propagation is by seeds or by cuttings of half-ripened wood under glass; also by layers.

ellíptica, Douglas. Shrub, to 8 ft.: lvs. elliptic to oval-oblong, obtuse or acute, usually undulate, glabrous above, densely tomentose beneath, 1½–3 in. long: 3 fls. in the axils of short and broad, pointed bracts; spikes rather dense, staminate 2–12 in. long, often branched, pistillate 1–3 in. long: fr. globose, silky tomentose. Calif. to New Mex. B.R. 1686. Gn. 33, p. 562; 37, p. 501; 39, p. 261; 51, p. 257; 53, p. 449; 55, p. 258; 57, p. 122; 63, p. 181; 67, p. 149; 76, p. 639. G.C. II. 22:425; III. 35:42, 43. Gn. W. 22:115. G. 20:30; 35:21. H.U. 2, p. 35. H.F. 1865: 198. G.L. 24:190.—This is the handsomest species, and stands about 10° of frost (sometimes more) in a sheltered position.

G. Fadyénii, Hook. (Fadyenia Hookeri, Griseb.). Shrub, to 15 ft.: lvs. elliptic to oblong, acute or mucronulate, glossy above, tomentose beneath or almost glabrous at length, 2–4 in. long: bracts oblong-lanceolate, remote: fr. tomentose. Jamaica, Cuba.—*G. flavéscens*, Wats. (G. Veatchii var. flavescens, Coult. & Evans). Shrub, to 8 ft.: lvs. elliptic, silky pubescent below, 1–2 in. long: spikes dense, about 1 in. long. Ariz., Utah, N. Mex.—*G. Frémóntii*, Torr. Shrub, to 10 ft.: lvs. ovate to oblong, acute, glabrous on both sides, yellowish green, 1–3 in. long: spikes dense, 2–5 in. long: with short bracts: fr. pedicelled, glabrous. Ore. to Calif. G.C. II. 15:431; III. 35:44.—*G. macrophýlla*, Benth. Shrub, to 6 ft.: lvs. ovate to oblong-ovate, glabrous above, villous-pubescent beneath, 2–5 in. long: spikes dense and short: fr. sessile. Mex.—*G. Thurétii*, Carr. (G. elliptica × G. Fadyenii). Shrub, to 15 ft.: lvs. elliptic to elliptic-oblong, whitish tomentose beneath, 2–5 in. long: bracts remote, with usually 1 fl. in each axil; spikes shorter than those of G. elliptica. Originated in France. R.H. 1869, p. 17; 1879, pp. 154, 155.—*G. Veatchii*, Kellogg. Spreading shrub, to 8 ft.: lvs. elliptic-ovate to ovate-oblong, acute, yellowish green, tomentose beneath, 1½–2½ in. long: spikes dense, 1–2 in. long: fr. sessile, usually silky tomentose. Nev. to Calif. and N. Mex. Named for J. A. Veatch, botanical explorer of Cedros Isl., Lower Calif.—*G. Wrightii*, Torr. Shrub, to 10 ft.: lvs. elliptic or elliptic-ovate, acutish and mucronate, glabrous or nearly so below, 1–2 in. long: spikes slender, about 2 in. long: fr. glabrous, nearly sessile. Ariz., Mex.

ALFRED REHDER.

GARÙGA (native East Indian name). *Burseràceæ.* This includes a deciduous East Indian tree, reaching 60 feet, and cultivated in southern Florida and California for its fruits, which are the size of a gooseberry, and are eaten raw, but chiefly pickled.

Tomentose or hairy plants: lvs. crowded at tips of branches, alternate, odd-pinnate; lfts. opposite, subsessile, serrate: fls. polygamous, large, panicled; calyx bell-shaped, 5-cut; petals 5, inserted on the tube of the calyx above the middle; stamens 10; ovary 4–5-celled; ovules in pairs: drupe with 5, or by abortion 1–3, stones, which are wrinkled and finally 1-seeded.—Species perhaps a dozen in India and Pacific islands to Austral.

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pinnàta, Roxbg. Tree, 30–40 ft., with lvs. 1 ft. or more long; lfts. obtusely crenate: fls. small, in a very large panicle: fr. a black drupe. India and Malaya to the Philippines.—Also cult. abroad under glass.

L. H. B.

GAS PLANT: *Dictamnus.*

GASTÈRIA (Greek, *gaster*, belly; referring to the usually swollen base of the flowers). *Liliàceæ*, tribe *Aloíneæ*. Mostly acaulescent and small succulents of similar decorative uses and treatment as Aloe.

Leaves usually elongated, crowded in rosettes or on short sts., usually 2-ranked: fls. with a red or rosy typically ventricose curved tube and short equal suberect greenish segms. about as long as the stamens and pistil. S. Afr. Species 43. Monog. by Berger in Engler, Das Pflanzenreich, hft. 33 (1908).

INDEX.

acinacifolia, 18.
angulata, 3, 4.
canaliculata, 7.
carinata, 15.
conspurcata, 2.
crassifolia, 6.
denticulata, 5.
disticha, 2, 3, 5.
Dregeana, 10.
ensifolia, 18.
excavata, 13.
falcata, 15.
fallax, 10.
formosa, 9.
glabra, 16.
glabrior, 7.
grandipunctata, 17.
intermedia, 1.
latifolia, 1, 15.
lingua, 5.
longifolia, 3.
maculata, 10.
major, 16.
marmorata, 6, 12.
minor, 16.
nigricans, 6, 7, 10.
nitens, 18.
nitida, 17.
obliqua, 10.
parvifolia, 14.
parvipunctata, 17.
picta, 9.
planifolia, 8.
pulchra, 11.
scaberrima, 1.
strigata, 15.
subnigricans, 7.
sulcata, 4.
truncata, 3.
venusta, 18.
verrucosa, 1.

A. *Fls. scarcely 1 in. long, mostly ventricose.*

B. *Lvs. radical, in 2 nearly straight ranks, not keeled.*

C. *The lvs. with pale raised warts.*

1. **verrucòsa,** Haw. (*Alòe verrucòsa*, Mill. *A. dísticha*, Linn. *A. verrúcula*, Medikus. *A. acuminàta* and *A. racemòsa*, Lam.). Cespitose: lvs. acute, somewhat concavely 3-sided, spreading, ½ x 4–6 in., dull gray, very rough with white crowded tubercles: infl. 2 ft. high, typically simple. Cape. B.M. 837. DC., Pl. Gr. 63. Berger 42, 43.—Varies in a form with lvs. 1 ft. long and branched infl., var. **latifòlia,** Salm (*Alòe lingua* var., Ker), B.M. 1322, f. 2, 3. Salm, Aloe § 29, f. 25; a form with large greener more mucronate lvs. with less crowded warts, var. **intermèdia,** Baker (*G. intermèdia*, Haw. *Alòe intermèdia*, Haw.), Salm, Aloe § 29, f. 24. B.M. 1322, f. 1; and a form with scarcely concave greener lvs. with the greenish warts somewhat in lines on the back, var. **scabérrima,** Baker (*G. intermèdia scabérrima*, Haw. *Alòe scabérrima* Salm), Salm, Aloe § 29, f. 26. Hybrids are reported between *G. verrucosa* and *G. pulchra; G. verrucosa intermedia* and *G. carinata* as well as *Haworthia radula;* and *G. verrucosa latifolia* and *G. brevifolia.*

CC. *The lvs. not white-warty.*

2. **conspurcàta,** Haw. (*G. disticha conspurcàta*, Baker. *Alòe conspurcàta*, Salm). Lvs. obtuse, mucronate, little concave, 1½ x 10–12 in., green, smooth except on the margin, with small often confluent white spots: infl. 2½–3 ft. high, simple. Cape. Salm, Aloe § 29, f. 31.

3. **angulàta,** Haw. (*G. disticha angulàta*, Baker. *G. longifòlia*, Haw. *Alòe angulàta*, Willd. *A. lingua longifòlia*, Haw.). Lvs. abruptly short-mucronate, a little concave on one or both faces, 2 x 8–10 in., one or both edges angularly doubled, dark green with small often confluent white spots: infl. 3 ft. high, exceptionally branching. Cape(?). Salm, Aloe § 29, f. 29.—A form with gutter-like lvs. is var. **truncàta,** Berger (*A. angulàta truncàta*, Willd.).

4. **sulcàta,** Haw. (*G. angulàta*, Haw. *Alòe sulcàta*, Salm. *A. lingua angulàta*, Haw.). Lvs. concavely strap-shaped, 4-angled, 1 x 4 in., dull green with small greenish little-raised dots: infl. 2 ft. high, simple; fls. little inflated. Cape. Salm, Aloe § 29, f. 32.

5. **língua,** Berger (*G. disticha*, Haw. *G. denticulàta*, Haw. *Alòe lingua*, Thunb. *A. dísticha*, R. & S.). Lvs. obtusely mucronate, oblong, somewhat concave, 2-edged, denticulate above, 2 x 8–10 in., green or grayish with more or less banded and pale greenish spots: infl. 3 ft. high, simple. Cape. Salm, Aloe § 29, f. 33. Berger 44.

6. **nígricans,** Haw. (*Alòe nígricans*, Haw. *A. obliqua*, Jacq.). Lvs. oblong, abruptly mucronate, 2-edged, 2 x 5–8 in., glossy dark green or purplish with more or less banded pale greenish spots: infl. 3 ft. high, sometimes branched. Cape. Salm, Aloe § 29, f. 7.—Varies into a less mottled form with shorter fleshier lvs., var. **crassifòlia,** Haw. (*A. lingua crassifòlia*, Ait. *A. crassifòlia*, R. & S.), B.M. 838. J.H. III. 60, p. 98; and a white- and rosy-marbled form with smaller lvs., var. **marmoràta,** Baker (*A. marmoràta*, Salm. *A. formòsa*, R. & S.).

7. **subnígricans,** Haw. (*G. nígricans subnígricans*, Baker. *Alòe subnígricans*, Spreng. *A. pseudonígricans*, Salm). Lvs. scarcely 1 in. wide, acute, green with small separate rather transversely arranged pale spots: infl. 3 ft. high, simple; fls. ventricose. Cape. Salm, Aloe § 29, f. 10.—Varies into a form with more concave lvs., **var. canaliculàta,** Salm; and a form with sword-like darker lvs., var. **glàbrior,** Haw. (*Alòe guttàta*, Salm. *A. nígricans denticulàta*, Salm. *G. nígricans guttàta*, Baker). Salm, Aloe § 29, f. 9.

BB. *Lvs. crowded along an evident if short st.*

C. *The lvs. in 2 straight or twisted ranks.*

8. **planifòlia,** Baker (*Alòe planifòlia*, Baker). Lvs. in straight ranks, narrow, abruptly mucronate, 2-edged, ¾ x 6–10 in., glossy green with more or less confluent oblong white spots, the minutely rough margin often rosy: infl. 6 ft. high, or more, simple; perianth very abruptly inflated below. Cape. Ref. Bot. 162.

9. **pícta,** Haw. (*Alòe Boureàna*, R. &. S., *A. Bowieàna*, Salm). Lvs. in twisted ranks, tongue-shaped, abruptly mucronate, somewhat concave and 3-sided, 1½–2 x 10–14 in., glossy dark green mottled with round white spots confluent below, the thickened margin subentire: infl. 3 ft. high, branched. Cape. Salm, Aloe § 29, f. 3.—Varies into the smaller var. **formòsa,** Berger (*Alòe Bowieàna formòsa*, Salm. *G. formòsa*, Haw.).

10. **maculàta,** Haw. (*G. obliqua*, Haw. *G. nígricans platyphýlla*, Baker. *Alòe maculàta*, Thunb. *A. obliqua*, Haw. *A. maculàta obliqua*, Ait.). Lvs. in somewhat twisted ranks, tongue-shaped, blunt or abruptly mucronate, 2-edged or with one margin doubled, 1¾–2 x 6–8 in., glossy dark green with more or less confluent large oblong spots or entirely white at base below, rough-margined: infl. 3–4 ft. high, branched. Cape. Salm, Aloe § 29, f. 1. B.M. 979. Berger 47.—Two varieties are distinguished: var. **fállax,** Haw. (*A. maculàta angústior*, Salm), with smaller whiter smooth lvs., and var. **Dregeàna,** Berger, with rough-margined lvs.

11. **púlchra,** Haw. (*Alòe maculàta púlchra*, Ait. *A. púlchra*, Jacq.). Lvs. in spiral ranks, falcate, narrowed from the base, acute, scarcely 1 x 8–10 in., glossy dark green with oblong white spots transversely or reticulately confluent, slightly rough-margined: infl. 3 ft. high, branched. Cape. Jacq., Schoenbr. 4:19. Salm, Aloe § 29, f. 2. DC., Pl. Gr. 91. B.M. 765. Miller, Icon. 292. Berger 47.—It is said to have been crossed with *G. verrucosa.*

CC. *The lvs. not 2-ranked.*

12. **marmoràta,** Baker. Lvs. smooth, lorate-lanceolate, rounded and cuspidate at tip, 1–1½ x 5–6 in., with one margin doubled, dark green with large greenish more or less confluent spots: infl. 2–2½ ft. high, branched. Cape.

BBB. *Lvs. nearly radical, typically keeled or triquetrous.*

C. *The lvs. in 2 spiral ranks.*

13. **excavàta,** Haw. (*Alòe excavàta,* Willd. *A. obscùra,* Willd.). Lvs. smooth, rather thin, spreading, lanceolate, mucronately acute, denticulate, 1–1½ x 4–5 in., dull pale green with small greenish white spots: infl. 2 ft. high, simple. Cape. Salm, Aloe § 29, f. 22. B.M. 1322, f. 4.

CC. *The lvs. not 2-ranked.*

14. **parvifòlia,** Baker. Lvs. thick, deltoid-oblong, submucronate, somewhat roughened on keel and margin, 1 x 2–3 in., purplish green with small whitish spots: infl. 1½ ft. high, simple. Cape. Berger 49.

15. **carinàta,** Haw. (*Alòe carinàta,* Mill. *A. tristicha,* Medikus). Lvs. thick, spreading, triangular-lanceolate, somewhat falcate, acute from the 2-in. base, 5–6 in. long, grooved above, dull green with coarse whitish warts sometimes in irregular lines: infl. 2½–3 ft., sometimes branched. Cape. B.M. 1331*a*. Salm, Aloe § 29, f. 20. Berger 50.—Varies into a larger smoother form, var. **strigàta,** Baker (*G. strigàta,* Haw. *A. carinàta lævior,* Salm); a form with narrower more falcate lvs. with smaller pale points, var. **falcàta,** Berger; and a form with short broad still finer-punctate lvs., var. **latifòlia,** Berger. It is said to have been crossed with *G. verrucosa intermedia.*

16. **glàbra,** Haw. (*Alòe glàbra,* Salm. *A. carinàta subglàbra,* Haw.). Lvs. triangular-lanceolate, acute or mucronate from the 2-in. base, 6–8 in. long, dull green with small scarcely raised whitish points: infl. 2½–3 ft. high. Cape. Salm, Aloe § 29, f. 19. B.M. 1331, lf. at left.—Respectively larger and smaller forms are sometimes designated as vars. **màjor** and **mìnor.**

17. **nítida,** Haw. (*Alòe nítida,* Salm). Lvs. triangular-lanceolate, acute from the 2-in. base, 6–9 in. long, smooth, light glossy green with white often banded spots, the margin roughish: infl. 3 ft. high, simple. Cape. Salm, Aloe § 29, f. 17.—Varies in a form with more numerous smaller pale dots, var. **parvipunctàta,** Salm (*A. nítida màjor,* Salm). B.M. 2304; and one with fewer, larger and more confluent spots, var. **grandipunctàta,** Salm (*A. nítida mìnor,* Salm).

AA. *Fls. 1½–2 in., little inflated, long-stalked: large for the genus.*

18. **acinacifòlia,** Haw. (*Alòe acinacifòlia,* Jacq.). Lvs. acute, 3-edged, spreading in a large 2-ranked rosette, 2 x 14 in., rather glossy dark green with scattered low pale dots: infl. about 4 ft. high, branched below. Cape. B.M. 2369. Berger 52.—Varies in a more erect-lvd. form, var. **ensifòlia,** Baker (*G. ensifòlia,* Haw.), Salm, Aloe § 29, f. 12; a form with more confluent low mottling, var. **nìtens,** Baker (*G. nìtens,* Haw. *Alòe nìtens,* R. & S.); and a narrower-lvd. form with somewhat seriate slightly raised whiter spots, var. **venùsta,** Baker (*G. venùsta,* Haw. *Alòe venùsta,* R. & S. *A. acinacifòlia venùsta,* Salm). It has been crossed with *Aloe striata.*

G. brevifòlia, Haw. Lvs. 3–4 in. long, lingulate, close together: fls. red, about 1 in. long. Afr.—*G. Hiltoniæ,* N. E. Br. Lvs. in a loose rosette, 16–18 in. long, broad at base, narrowed above, obliquely keeled: fls. pendulous, nearly 1 in. long, rose with green-keeled lobes. S. Afr.—*G. obtusifòlia,* Haw. Lvs. thinner than in G. sulcata and shorter than in G. lingua.

WILLIAM TRELEASE.

GASTÒNIA PALMÀTA: *Trevesia.*

GASTROCHÌLUS (Greek-made name, alluding to the swollen lip). *Zingiberàceæ.* A very few Indian and Malayan herbs, perennial or annual, that may sometimes be found in choice collections of hothouse plants. Allied to Hedychium and Kaempferia, differing from the former in the character of the connective and from the latter in the sac-form lip: sometimes provided with a creeping rootstock: st. very short or none, or reaching 12 in. high: lvs. oblong and acute: fls. mostly white with lip yellow or pink, solitary or in spikes; corolla-tube slender and the segms. connivent; staminodia present and petal-like; lip oblong and entire but the margin sinuate, exceeding the corolla; ovary 3-celled, each cell many-ovuled. *G. pulchérrima,* Wall., is leafy-stemmed, to 12 in., from a creeping rootstock: fls. white in a spike 2–3 in. long, the lip tinged pink. H. U. 4, p. 100. *G. longiflòra,* Wall., is acaulescent, with lvs. to 12 in. long: fls. 1 or 2 from the crown, long-tubed, white, the lip tinged red. The Gastrochilus of Don is orchidaceous, and is now referred to Saccolabium.

L. H. B.

GASTROLÒBIUM (Greek-made name, referring to the swollen pods). *Leguminòsæ.* More than 30 shrubs of W. Austral., little known in cult. Lvs. simple and entire, mostly stiff: fls. yellow or in part purple-red, racemose in corymbs or whorls; calyx 5-lobed; petals clawed, the standard orbicular or kidney-shaped, and emarginate, the wings oblong, and the keel broad and short; stamens free; style filiform, incurved: pod turgid, ovoid or nearly globular. *G. velùtinum,* Lindl. A handsome shrub: lvs. in 3's or 4's, varying from obovate to linear-cuneate, very obtuse, emarginate, ¾in. or less long: fls. orange-red, on villous pedicels, in terminal clusters to 1½ in. long: pod ovoid, about ¼in. long. *G. cuneàtum,* Henfr., may be the same as the foregoing, perhaps with longer racemes. J.F. 3:258. *G. villòsum,* Benth. Decumbent with ascending sts.: lvs. opposite, ovate to almost lanceolate, very obtuse, 1–2 in. long: fls. in terminal pedunculate racemes 3–4 in. long; standard orange-red, shorter lower petals purple-red: pod broadly ovoid, about ⅛in. long. B.R. 33:45. J.F. 4:341. *G. ovalifòlium,* Henfr. Diffuse shrub: lvs. mostly opposite, ovate or oblong or orbicular, 1 in. or less long, often emarginate: fls. nearly sessile in racemes 1–3 in. long, orange or orange-red, the lower petals deeply colored. J.F. 3:247, 324.

L. H. B.

GASTRONÈMA: A section of *Cyrtanthus.*

GAULTHÈRIA (named by Kalm after Dr. "Gaulthier," a physician in Quebec, whose name was really written Gaultier). *Ericàceæ.* Ornamental woody plants grown for the attractive flowers and fruits and also for their handsome evergreen foliage.

Evergreen erect or procumbent shrubs, rarely small trees, usually hairy and glandular: lvs. petioled, roundish to lanceolate, mostly serrate: fls. in terminal panicles or axillary racemes or solitary; calyx 5-parted; corolla urceolate, 5-lobed; stamens 10; ovary superior: fr. a 5-celled, dehiscent caps., usually inclosed by the fleshy and berry-like calyx.—About 90 species in the warmer and subtropical regions of Asia, Austral., and in Amer. from Canada to Chile. Some have edible fruits, and an aromatic oil used in perfumery and medicine is obtained from *G. procumbens* and several Asiatic species.

This genus includes the wintergreen and some other ornamental low aromatic plants with alternate, evergreen leaves, white, pink or scarlet, often fragrant flowers in terminal or axillary racemes or solitary, and with decorative, berry-like red or blackish fruit. *G. procumbens* is fully hardy North, while the other North American species are somewhat tenderer and need protection during the winter; *G. Veitchiana* promises to be hardy as far north as Massachusetts. They are well adapted for borders of evergreen shrubberies as well as for rockeries, and in suitable soil they are apt to form a handsome evergreen ground-cover. Most of the foreign species can be grown only South or as greenhouse shrubs. They grow best in sandy or peaty, somewhat moist soil and partly shaded situations. Propagation is by seeds, layers or suckers, division of older plants, and also by cuttings of half-ripened wood under glass.

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A. *Fls. solitary.*

procúmbens, Linn. WINTERGREEN. CHECKERBERRY. BOXBERRY. PARTRIDGE BERRY. St. creeping, sending up erect branches to 5 in. high, bearing toward the end 3–8 dark green, oval or obovate, almost glabrous lvs., 1–2 in. long, with ciliate teeth: fls. solitary, nodding; corolla ovate, white, about ¼in. long; anthers with 4 awns; filaments pubescent: fr. scarlet. July–Sept. Canada to Ga., west to Mich. B.M. 1966. L.B.C. 1:82. Gn. 31, p. 379.

AA. *Fls. in racemes.*

Shállon, Pursh. Low shrub, to 2 ft., with spreading, glandular-hairy branches: lvs. roundish-ovate or ovate, cordate or rounded at the base, serrulate, 2–4 in. long: fls. nodding, in terminal and axillary racemes; corolla ovate, white or pinkish: fr. purplish black, glandular, hairy. May, June; fr. Sept., Oct. Brit. Col. to Calif. Called "shallon" or "salal" by Indians. B.M. 2843. B.R. 1411. L.B.C. 14:1372. Gn. 31, p. 379.

Veitchiàna, Craib. Shrub, to 3 ft., sometimes decumbent: branchlets setose: lvs. elliptic to oblong or obovate-oblong, short-apiculate, broadly cuneate or nearly rounded at the base, setose-serrulate, glabrous and lustrous above, paler below and setose on the veins while young, 1½–3½ in. long: fls. in axillary and terminal villous racemes 1–2 in. long, densely bracteate, the bracts as long or longer than the pedicels; corolla ovate, white, ¼in. long: fr. indigo-blue. May, June; fr. Aug., Sept. W. China.

G. antípoda, Forst. Shrub, to 5 ft., sometimes procumbent, hairy: lvs. orbicular to oblong, ¼–½in.: fl. solitary, white or pink, campanulate. New Zeal., Tasmania.—*G. coccínea,* HBK. Shrub, to 2 ft., hairy: lvs. roundish ovate, about 1 in.: fls. slender-pedicelled, in elongated, secund racemes; corolla ovate, pink. Venezuela. R.H. 1849:181.—*G. ferrugínea,* Cham. & Schlecht. (G. ignescens, Lem.). Small shrub, rufously hairy: lvs. ovate or oblong, 1–2 in.: fls. almost like those of the preceding species. Brazil. B.M. 4697. J.F. 3:265; 4:371.—*G. fragrantíssima,* Wall. Shrub or small tree, glabrous: lvs. elliptic to lanceolate, 2½–3½ in. long: racemes axillary, erect, shorter than the lvs.; corolla white or pinkish, globular-ovate. Himalayas, Ceylon. B.M. 5984.—*G. myrsinítes,* Hook. Allied to G. procumbens. Lvs. orbicular or broadly ovate, ½–1 in. long: corolla broadly campanulate; filaments glabrous; anthers without awns. Wash. to Calif. and Colo.—*G. nummularioídes,* D. Don (G. Nummularia, DC.). Procumbent: branches densely rufously hairy: lvs. orbicular to ovate, ½–1 in. long: fls. solitary, ovate, white. Himalayas. G.C. II. 22:457.—*G. oppositifólia,* Hook. f. Shrub, to 8 ft.: lvs. mostly opposite, ovate, cordate, bluntly toothed, 1½–2½ in. long: fls. white, urceolate, ½in. long, in terminal panicles 3–4 in. long. New Zeal. G.C. III. 52:109. Gn. 75, p. 412.—*G. ovatifólia,* Gray. Procumbent, with ascending and sparingly hairy branches: lvs. ovate, acute, 1–1½ in. long: fls. solitary, campanulate: fr. scarlet. Brit. Col. to Ore.—*G. pyroloídes,* Hook. f. & Thom. (G. pyrolæfolia, Hook. f.). Low shrub, sometimes procumbent, almost glabrous: lvs. elliptic-obovate, about 1½ in. long: racemes few-fld., axillary. Himalayas, Japan. Var. *cunéata,* Rehd. & Wilson. Branchlets minutely villous: lvs. narrow, oblong-obovate, cuneate: ovary and fr. villous. W. China.—*G. trichophýlla,* Royle. Dwarf: lvs. elliptic, ciliate, ⅛–½ in. long: fls. axillary, pinkish: fr. blue. Himalayas, W. China. B.M. 7635.

ALFRED REHDER.

GAÙRA (Greek, *superb*). *Onagràceæ.* This includes several herbs which are distinct in appearance, but scarcely possess general garden value, although they are pleasant incidents in the hardy border for those who like native plants.

Annual, biennial or perennial plants confined to the warmer regions of N. Amer.: lvs. alternate, sessile or stalked, entire, dentate, or sinuate: fls. white or rose, in spikes or racemes; calyx-tube deciduous, obconical, much prolonged beyond the ovary, with 4 reflexed lobes; petals clawed, unequal; stamens mostly 8, with a small scale-like appendage before the base of each filament; stigma 4-lobed, surrounded by a ring or cup-like border: fr. nut-like, 3–4-ribbed, finally 1-celled, and 1–4-seeded.—Species 20–25. The bloom ascends the slender racemes too slowly to make the plants as showy as possible. The best kind is *G. Lindheimeri,* which has white fls. of singular appearance, with rosy calyx-tubes. Gauras are easily prop. by seed. They prefer light soils, and the seedlings can be transplanted directly into permanent quarters.

A. *Height 3 ft.: fls. white.*

Líndheimeri, Engelm. & Gray. St. hairy and more or less branched above: lvs. lanceolate or more often spatulate with a few wavy teeth and recurved margins: fls. in a loose spike. Texas and La. R.H. 1851:41; 1857, p. 262. H.F. 8:145. G.W. 14, p. 100.

AA. *Height 1 ft.: fls. rosy, turning to scarlet.*

coccínea, Nutt. An erect or ascending, usually much-branched perennial: lvs. numerous, lanceolate to linear or oblong, repand-denticulate or entire: fls. in spikes, very showy, except that the whole spike does not come into flower at one time: fr. 4-sided. Manitoba to Mont. and Texas.

WILHELM MILLER.
N. TAYLOR.†

GAÙSSIA (probably from a personal name). *Palmàceæ.* One slender pinnate-leaved palm, reaching about 20 ft., from Cuba, recently intro. in S. Calif. It is allied to Hyophorbe and Pseudophœnix. **G. princeps,** Wendl., is a spineless species, the st. thickened below but very slender above: lvs. pinnatisect, the pinnæ crowded and narrow-linear and entire or 2-cut: fls. very small, on filiform branches, monœcious; spadix long-stalked: fr. small, purple or red. L. H. B.

GAŸA (for Jacques and perhaps Claude Gay, writers on the plants of W. S. Amer.). *Malvàceæ.* About a dozen herbs, shrubs or small trees of S. Amer. except the one described below: mostly tomentose: lvs. usually undivided: fls. yellow or white, axillary or terminal, pedunculate, with no bracteoles; calyx 5-parted; staminal column split at apex into many parts; ovary many-celled and style-branches as many as the cells, the ovules 1 in each cell. *G. Lyallii,* Baker (*Plagiánthus Lyallii,* Gray), the lacebark, endemic in the southern island of New Zeal., is recorded in horticultural literature abroad. It is said by Cheeseman to be one of the most beautiful trees of the New Zealand flora, often forming a broad fringe to the subalpine beech forests. It is partly deciduous at high elevations, but is evergreen in certain river valleys. It is a small spreading tree 15–30 ft. high: lvs. ovate, acuminate, usually double-crenate, sometimes somewhat lobed: fls. to 1 in. diam., white, in axillary fascicles or rarely solitary; petals obliquely obovate, retuse. G.C. III. 50:56, and Suppl. Sept. 23, 1911. B.M. 5935.—Hardy in the south of England, where it blooms profusely. L. H. B.

GAYLUSSÀCIA (after J. L. Gaylussac, eminent French chemist; died 1850). Syn., *Adnària. Ericàceæ,* tribe *Vaccínieæ.* HUCKLEBERRY. Small shrubs, some grown for their handsome flowers, others valued for their edible fruits.

Evergreen or deciduous: lvs. alternate, short-petioled, usually entire: fls. in axillary, usually few-fld. racemes; calyx 5-lobed, persistent; corolla tubular-campanulate or urceolate; stamens 10; anthers acute; ovary inferior, 10-celled, each cell with 1 ovule: fr. a berry-like drupe with 10 nutlets.—About 50 species in E. N. Amer. and S. Amer. Closely allied to Vaccinium, distinguished by the 10-celled ovary, each cell with 1 ovule.

The huckleberries are low shrubs with white, red, or reddish green flowers, and blue or black mostly edible fruits. The deciduous species are hardy North, but are of little decorative value, the handsomest being *G. dumosa,* while the evergreen species, all inhabitants of the South American mountains, except the half-hardy *G. brachycera,* are often very ornamental in foliage and flowers, but tender and hardly cultivated in this country. They grow best in peaty or sandy soil and in shaded situations; but *G. baccata* thrives well also in drier localities and exposed to the full sun; like other Ericaceæ, they are all impatient of limestone. Propagated by seeds, layers or division; the evergreen species by cuttings of half-ripened wood under glass. See also *Vaccinium* for cultivation.

A. *Lvs. evergreen, obtusely serrate.*

brachýcera, Gray. Low shrub, with creeping and ascending st. and spreading angled glabrous branches: lvs. oval, glabrous, ½–1 in. long: racemes short, with few white or pinkish fls.: fr. blue. May, June; fr. July, Aug. Pa. to Va. B.M. 928. L.B.C. 7:648 (as *Vaccinium buxifolium*).

AA. *Lvs. deciduous, entire.*

B. *Fls. in loose racemes; corolla campanulate.*

C. *Plant glandular-pubescent.*

dumòsa, Torr. & Gray. Shrub, to 2 ft., with creeping st. and almost erect, somewhat hairy and glandular branches: lvs. obovate-oblong to oblanceolate, mucronate, shining above, leathery, 1–2 in. long: fls. white or pinkish; bracts foliaceous and persistent: fr. black, usually pubescent, rather insipid. May, June; fr. Aug., Sept. Newfoundland to Fla. and La. in moist sandy or swampy soil. B.M. 1106 (as *Vaccinium*).

1623. Gazania splendens. (×½)

CC. *Plant slightly pubescent or glabrous.*

frondòsa, Torr. & Gray. Blue Huckleberry. Dangleberry. Tangleberry. Shrub, to 6 ft., with spreading, usually glabrous branches: lvs. oblong or oval-obovate, obtuse or emarginate, pale green above, whitish beneath, membranaceous, 1–2 in. long: fls. slender-pedicelled; corolla broadly campanulate, greenish purple: fr. blue, with glaucous bloom, sweet. May, June; fr. July. N. H. to Fla., west to Ky., preferring moist, peaty soil. Em. 2:451. G.C. III. 7:580.

ursìna, Torr. & Gray. Shrub, to 6 ft., with somewhat pubescent, spreading branches: lvs. obovate to oblong, acute, membranaceous, 2–4 in. long: fls. white or pinkish: fr. black, shining, sweet. May, June; fr. July, Aug. N. and S. C.—Harlan P. Kelsey writes of this species: "Shrub 2 to 6 feet high; very local in a few counties in southwestern North Carolina, though common in these stations. Locally it is known as 'buckberry,' a name given by the native mountaineers from the fact that deer feed on the very abundant clustered fruit in late summer. The berries are much used for pies and jams, and have a most peculiar and pleasant acid flavor, unlike any other Vaccinium. It promises to be a valuable addition to our garden fruits."

BB. *Fls. in short, sessile racemes; corolla ovate.*

baccàta, Koch (*G. resinòsa,* Torr. & Gray). Black Huckleberry. Erect shrub, to 3 ft., resinous when young: lvs. oval or oblong-lanceolate, mucronulate, yellowish green above, pale beneath, 1–1½ in. long: fls. short-pedicelled, nodding, reddish: fr. black, rarely white, sweet. May, June; fr. July, Aug. Newfoundland to Ga., west to Wis. and Ky., preferring sandy or rocky soil. Em. 451. B.M. 1288 (as Vaccinium). I.T. 4:152. Var. **glaucocárpa,** Rob. Frs. larger, blue with glaucous bloom.

G. Pseùdo-Vaccínium, Cham. & Schlecht. Evergreen, usually glabrous shrub, to 3 ft., with elliptic, entire lvs. and red fls. in secund, many-fld. racemes. Brazil. B.R. 30:62. R.H. 1845:285.

Alfred Rehder.

GAZÀNIA (after Theodore of Gaza, 1393–1478, translator of Aristotle and Theophrastus; by some considered to be derived from Greek, *riches,* owing to the splendid floral coloring). *Compósitæ.* Showy plants grown in a cool greenhouse or in the open border in summer.

Herbaceous, mostly perennial, rarely annual, with short sts. or none: lvs. crowded at the crown of the root, or scattered along the st.: involucral scales in 2 or several rows, cup-like at the base, toothed at the apex: achenes wingless, villous; pappus in 2 series of very delicate, scarious, toothed scales, often hidden in the wool of the achene.—Species 24–30. This group contains some of the finest of the sub-shrubby composites from the Cape of Good Hope. They have a wide range of color,—pure white, yellow, orange, scarlet, and the backs of the rays are in some cases rich purple, and even azure-blue. Their foliage is often densely woolly beneath, and the range of form is unusual. The group is also notable for the spots near the base of the rays of *G. Pavonia* and some others. These markings suggest the eyes of a peacock's tail. The plants are also remarkable for their behavior at night, when they close their fls. and turn their foliage enough to make the woolly under sides of the lvs. more conspicuous.

Gazanias are now rarely met with in some of the oldest-fashioned florists' establishments. Few of the more prominent firms keep them now, and they may be said to be practically out of the trade in America. All the kinds described below are old garden favorites abroad, particularly *G. rigens,* a common bedding plant, cultivated for nearly a century and a half, but whose precise habitat has never been ascertained. They are of easy culture in the cool greenhouse, and are commended for summer use in the borders of those who can keep them under glass in winter. They can be rapidly propagated in midsummer by cuttings made from the side shoots near the base and placed in a close frame.

A. *Color of heads yellow.*

B. *Rays not spotted: heads 2 in. across.*

unifldra, Sims. Sts. woody at the base, spreading 6–12 in. or more from a center: lvs. varying as mentioned above. The woolliness also varies greatly: sometimes the whole plant is snowy white; sometimes the whiteness is confined to the under sides of the lvs. B.M. 2270. L.B.C. 8:795.—The involucre is woolly, according to Harvey, but the pictures cited do not show it. This and *G. rigens* have short sts. with branches alternately leafy, while *G. pinnata, G. Pavonia* and *G. pygmæa* have little or no st. and the lvs. radical or tufted at the ends of the short branches.

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BB. *Rays spotted at base: heads 3 in. or more across.*

pinnàta, Less. Rootstock perennial, fibrous: lvs. commonly pinnate (some simple); lobes oblong or linear in several pairs; white on both surfaces and stiff-hairy: peduncle not much longer than lvs.; involucral scales acuminate, particularly the inner ones. Harvey names 6 botanical varieties.

AA. *Color of heads orange: rays spotted at base: heads 3 in. or more across.*

B. *Lvs. mostly entire and spatulate.*

C. *Basal markings containing brown.*

rìgens, R. Br. Sts. short and densely leafy or diffuse, laxly leafy, with ascending branches: lvs. sometimes sparingly pinnatifid, i. e., with only 1 or 2 side lobes, white beneath except on the midrib: heads large and showy, 1½ in. wide, the rays orange, disk purplish black. B.M. 90 (as *Gorteria rigens*) shows a head of scarlet rays, with basal markings of brown, black and white.

CC. *Basal markings without brown.*

splèndens, Hort. Fig. 1623. Hybrid, said to resemble *G. uniflora* in habit but dwarfer and more compact. Of the kinds in common cult. it is nearest to *G. Pavonia* in coloring of fls. H.F. II. 4:240.

BB. *Lvs. mostly pinnate.*

Pavònia, R. Br. PEACOCK GAZANIA. Involucral scales short, the inner broad, acute or subacute. B.R. 35 shows markings of brown, white, yellow and blue, which are marvelous in design and precision of execution.

AAA. *Color of heads white above.*

pygmæa, Sond. Crown woody and much divided: lvs. spatulate, entire: rays white, striped purple beneath. Gn. 47:288. I.H. 43:53. B.M. 7455. G. 30:101. Var. **maculàta,** N. E. Br. Rays pale creamy white, with a blackish spot at the base, reverse striped dull purple. Var. **supérba,** N. E. Br. Rays white, unspotted, reverse striped bluish. Var. **lùtea,** Hort. Fl.-heads very large, chrome-yellow.—This species is very variable in its involucral scales, which may be short or long, sometimes cup-shaped at the base, and again almost free. This upsets one of the most important features of Harvey's key.

A hybrid between G. nivea, Less., and G. longiscapa, DC., known as *G. hýbrida*, has been described as a very profuse bloomer, flowering continuously from June to late autumn. R.H. 1900:209. Gt. 47:134.—*G. longiscàpa*, DC. (G. stenophylla, Hort.), is a white-woolly perennial with a glabrous peduncle which is shorter than the lvs.: involucre glabrous.—*G. nívea*, DC. Very dwarf, almost woody: lvs. crowded, hoary-tomentose on both sides: peduncle not exceeding the lvs.: involucre tomentose. Last two probably not cult. in Amer.

WILHELM MILLER.
N. TAYLOR.†

GEISSORHÌZA (Greek words alluding to the coats of the bulb, which cover it somewhat like overlapping tiles). *Iridàceæ*. Ixia-like half-hardy Cape bulbs, which are dormant from August to November and are usually flowered under glass in spring and early summer.

Cormous: lvs. few, distichous: fls. in different colors, in open, simple or forked spikes; perianth nearly regular, rotate, with a cylindrical tube; stamens 6, inserted in the throat; ovary 3-celled, becoming a small oblong caps.—Species about 30, 1 in Madagascar and the others in S. Afr. The genus has a wide range in habit and in color of fls., but these plants are presumably inferior to ixias for general culture. The following species are advertised.

rochénsis, Ker. Corm ¼in. diam., globular: lvs. 3, one of them on the st., glabrous, basal ones narrow, few-ribbed: st. 3–6 in., simple or forked, with 1 fl. at the top; st.-sheath loose and swelling: fls. violet-purple, 1–2 in. across; perianth-tube shorter than the spathe; segms. with a blotch at the base. B.M. 598, where the whole plant is a trifle over 3 in. high and the fls. purple, with a dark red eye, the latter surrounded by a pale blue circle.

hírta, Ker. Lvs. hairy: fls. 2–6 in a loose spike, bright red, the tube very short, segms. not blotched: corm ½in. diam., globular.—Offered in S. Calif. L. H. B.

GEITONOPLÈSIUM (Greek-made name, *near neighbor*, in allusion to its kinship to another genus). *Liliàceæ*. Woody stemmed twiners of Austral. and Pacific islands of probably 2 species; one is offered in S. Calif. Fls. small, in loose terminal clusters: lvs. alternate, linear to ovate, very short-stalked, lightly nerved; perianth with 6 oblong distinct segms., the 3 outer ones more or less hood-shaped at times, the inner ones flat and obtuse; stamens 6, included: fr. a nearly globular berry with thin pulp and becoming dry; seeds irregular, black. **G. cymòsum,** Cunn. Tall-climbing, with wiry sts.: fls. purplish green, the perianth ⅛in. or less long, the pedicels very short and jointed under the fl.: berry dark blue, ½in. or less diam.; seeds few. Queensland to Victoria. B.M. 3131. L. H. B.

GELSÈMIUM (from the word *Gelsemino*, the Italian name of the true jessamine). *Loganiàceæ*. Climbing shrubs, with evergreen foliage and yellow flowers.

Glabrous, twining, shrubby plants, with opposite, rarely whorled lvs., and showy, hypogynous, perfect, regular, yellow and very fragrant fls., in axillary and terminal cymes, the pedicels scaly-bracted: calyx imbricated, deeply 5-parted; corolla funnelform, 5-lobed, imbricated in the bud; stamens 5, epipetalous; ovary solitary, superior, 2-celled; ovules numerous, on narrow placentæ; style slender, 4-cleft: fr. an elliptic, septicidal caps., flattened contrary to the partition; valves boat-shaped, 2-cleft at the apex; seeds flattened and winged.—There are 2 species in the genus, one American the other Chinese. The American or Carolina yellow jessamine is a well-known woody twiner of the S., bearing evergreen foliage and a profusion of bright yellow, very fragrant fls. The cymes of the Chinese species are terminal and trichotomous. Our species is very desirable for covering banks and fences in any soil. It is also grown occasionally in conservatories. The rhizomes and roots are used medicinally as a nervine, antispasmodic and sedative. The true jessamine is *Jasminum officinale* (*Oleaceæ*) of Eu.

sempérvirens, Ait. f. CAROLINA YELLOW JESSAMINE. St. high-climbing: lvs. ovate, or lanceolate, shining, entire, short-petioled, 1–3 in. long: cymes terminal, 1–6-fld.; the fls. dimorphous; corolla 1–1½ in. long. Low woods and thickets, Va. to Fla., Texas and Guatemala; early flowering. B.M. 7851. G.W. 9, p. 494. K. M. WIEGAND.

GENÉTYLLIS: *Darwinia.*

GENÌPA (Brazilian name). *Rubiàceæ*. This includes a West Indian shrub allied to the Cape jasmine and barely known to American horticulture. Genipa and Gardenia are difficult to separate.

Small trees or shrubs: lvs. with short or no stalks, opposite, large, leathery, obovate or lanceolate, shining: cymes axillary, few-fld.; fls. white to yellowish; calyx-limb bell-shaped, truncated, or 5-toothed; corolla salver-shaped, limb twisted to the left, 5-parted; stigma club-shaped or bifid; ovary 1-celled; placentas 2, almost touching each other in the axis: berries edible.

clusiifòlia, Griseb. A shrub 4–10 ft. in the wild, not so large in cult.: lvs. 4 in. or less long, black when dried, obovate, glabrous: corymbs short-peduncled; calyx-limb 5-cut, the pedicels as long as the calyx; corolla glabrous, the tube nearly as long as the lobes: berry ovoid. W. Indies.

americàna, Linn. A small tree: lvs. 5–10 in. long, lanceolate-oblong, glabrous: pedicels shorter than the

calyx; corolla silky, white, about 1 in. across: berry similar to last, but is "highly commended in cookery" according to Reasoner, by whom the plant was intro. (1914). W. Indies.—The fr. is largely used in Trop. Amer. as a preserve under the name "genipop." It is often used as a kind of marmalade and has been called "marmalade-box" in Surinam. N. Taylor.†

GENÍSTA (ancient Latin name). *Leguminòsæ.* Ornamental woody plants chiefly grown for their handsome yellow, rarely white, flowers.

Deciduous or half-evergreen, sometimes nearly leafless shrubs, unarmed or spiny: branches usually striped and green: lvs. alternate, rarely opposite, entire, simple or sometimes 3-foliolate: fls. papilionaceous, in terminal racemes or heads, rarely axillary, yellow, rarely white; calyx 2-lipped, with the upper lip deeply 2-parted; style incurved: pod globular to narrow-oblong, 1- to many-seeded, dehiscent, rarely indehiscent.—About 100 species in Eu., Canary Isls., N. Afr. and W. Asia. Allied to Cytisus, but without callose appendage at the base of the seeds. The Genista of florists is Cytisus.

The genistas are ornamental, usually low shrubs with showy flowers, appearing profusely in spring or summer, and followed by small, insignificant pods. None of the species is quite hardy North, but *G. tinctoria, G. pilosa, G. germanica* and some other European species will do well in a sheltered position or if somewhat protected during the winter, while the others are more suited for cultivation in southern regions. They are essentially plants suited to drier climates and most of them do well in California. They are adapted for covering dry, sandy banks and rocky slopes, and for borders and rockeries. They grow in any well-drained soil, and like a sunny position. Propagate by seeds, sown in spring, also by layers and by greenwood cuttings under glass.

INDEX.

ætnensis, 9.	hispanica, 6.	polygalæfolia, 13, 14.
cinerea, 10.	humilior, 14.	sagittalis, 16.
elata, 14.	*mantica*, 14.	*sibirica*, 14.
ephedroides, 8.	Martinii, 4.	sphærocarpa, 2.
ferox, 3.	monosperma, 1.	tinctoria, 14.
florida, 12.	pilosa, 15.	umbellata, 7.
germanica, 5.	plena, 14.	virgata, 11, 14.

A. *Color of fls. white.*

1. **monospérma,** Lam. (*Retàma monospérma*, Boiss.). Shrub, to 10 ft. or more with slender grayish branches, almost leafless: lvs. small, simple or rarely 3-foliolate, generally linear or linear-spatulate, silky: fls. white, fragrant, in short lateral racemes; corolla silky; calyx purple: pod broadly oval, 1–2-seeded. Feb.–April. Spain, N. Afr. B.M. 683. B.R. 1918. Gn. 55, p. 213; 62, p. 15. G.W. 15, p. 412.

AA. *Color of fls. yellow.*

B. *Twigs striped, not winged.* (Nos. 2–15.)

C. *Pod globular, indehiscent, 1-seeded.*

2. **sphærocárpa,** Lam. Similar to the preceding, but lower and more upright, leafless: fls. yellow, very small, in numerous panicled racemes; corolla glabrous. May, June. Spain, N. Afr.

CC. *Pod oval to linear, dehiscent.*

D. *Shrubs spiny.*

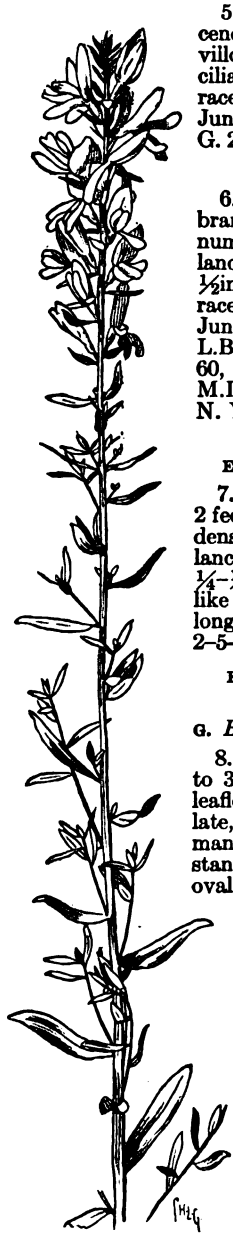
E. *Infl. racemose.*

F. *Spines stout: habit upright, to 6 ft.*

3. **fèrox,** Poir. Erect shrub, to 6 ft., with many stout spines: lvs. simple, rarely 3-foliolate, oblong to obovate, almost glabrous: fls. in numerous terminal racemes along the branches; corolla glabrous, over ½in. long, fragrant: pod linear, densely silky, many-seeded. Spring, in Calif. in autumn and winter. N. Afr. B.R. 368.

FF. *Spines slender: habit decumbent to upright, to 2 ft.*

4. **Martínii,** Verguin & Soulié (*G. Scorpius* × *G. Villarsii*). Decumbent shrub: branchlets tomentose: lvs. linear-lanceolate, simple, whitish pubescent on both sides, small: fls. axillary, forming terminal slender racemes; calyx pubescent; standard and keel silky. S. France; natural hybrid. Cult. in Calif.



1624. Dyer's Greenweed, Genista tinctoria. (×⅓)

5. **germánica,** Linn. Erect or ascending spiny shrub, to 2 ft., with villous branches: lvs. elliptic-oblong, ciliate: fls. small, in 1–2-in. long racemes: pod oval, villous, few-seeded. June, July. Cent. and S. Eu. R.F. G. 22:2085.

EE. *Infl. head-like.*

6. **hispánica,** Linn. Densely branched shrub, about 1 ft. high, with numerous thin spines: lvs. ovate-lanceolate, pubescent, not exceeding ½in.: fls. in 3–12-fld. short head-like racemes: pod rhombic, hirsute. May, June. Spain, S. France, N. W. Italy. L.B.C. 18:1738. R.H. 1888:36. Gn. 60, p. 395; 62, p. 95. G.M. 45:69. M.D.G. 1907:388.—Hardy in W. N. Y.

DD. *Shrubs unarmed.*

E. *Fls. in terminal heads, sessile.*

7. **umbellàta,** Poir. Erect shrub, to 2 feet, with rigid branches, forming a dense bush: lvs. simple or 3-foliolate, lanceolate or linear-lanceolate, silky, ¼–½in. long: fls. in 10–30-fld. umbel-like heads; corolla silky, over ½in. long: pod linear-oblong, tomentose, 2–5-seeded. April, May. Spain.

EE. *Fls. in racemes, or axillary.*

F. *Habit upright.* Nos. 8–14.

G. *Branches rigid: pod 1-seeded, silky.*

8. **ephedroides,** DC. Erect shrub, to 3 ft., with rigid branches, almost leafless: lvs. sessile, simple or 3-foliolate, linear, almost glabrous: fls. in many-fld. terminal racemes, small; standard much shorter than keel: pod oval, 1-seeded, silky. April, May. Sardinia, Corsica, Sicily.

GG. *Branches slender: pod 1–10-seeded.*

H. *The fls. axillary on last year's branchlets.*

9. **ætnénsis,** DC. Shrub, to 6 ft., with slender branches, nearly leafless: lvs. simple, small, linear, silky: fls. axillary, forming loose, terminal racemes, fragrant; keel shorter than the standard: pod glabrous at maturity, oblique-oval, 1–3-seeded. June, July. Sicily, Sardinia. B.M. 2674.

10. **cinèrea,** DC. Shrub, to 3 ft.: branches grooved, pubescent while young, sparsely leafy: lvs. simple, lanceolate, pubescent on both sides, ⅓–½in. long: fls. 1–3, axillary, forming terminal racemes to 8 in. long; calyx pubescent; keel pubescent outside: pod 2–5-seeded, silky. April–June. S. Eu., N. Afr. B.M. 8086. G.M. 52:511; 53:507.—This species does not seem to be in the trade at present, but it deserves attention on account of its copious, brilliant yellow fls.

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HH. *The fls. in terminal racemes on the young growth.*

I. *Pod pubescent, 1–4-seeded.*

11. **virgàta,** Link (*Spártium virgàtum,* L'Her.). Shrub, to 8 ft., with slender branches: lvs. lanceolate to elliptic, silky-villous, ¼–½in. long: fls. in numerous short 3–6-fld. racemes; standard and keel silky: pod oblong, 1–3-seeded, villous. May–July. Madeira. B.M. 2265. F. 1875:169.

12. **flórida,** Linn. Erect shrub, to 5 ft., with glabrous striped branches: lvs. spatulate-oblong or lanceolate, silky beneath, ⅓–⅔ in. long: fls. in dense, many-fld. racemes; corolla glabrous: pod oblong or narrow-oblong, silky, 2–4-seeded. April–July. Spain.

II. *Pod glabrous or slightly pubescent, rarely densely so, 3–10-seeded.*

13. **polygalæfólia,** DC. Erect shrub, to 6 ft., with somewhat silky branches: lvs. spatulate-oblong, glabrous above, sparingly silky beneath, ½–⅔in. long: fls. in many-fld. slender racemes; standard and wings glabrous, keel silky: pod oblong or narrow-oblong, almost glabrous, 3–6-seeded. May–July. Spain, Portugal.

14. **tinctória,** Linn. (*G. sibírica,* Hort. *G. polygalæfólia,* Hort., not DC.). DYER'S GREENWEED. Fig. 1624. Erect shrub, to 3 ft., with striped, glabrous or slightly pubescent branches: lvs. oblong-elliptic or oblong-lanceolate, almost glabrous, ciliate, ½–1 in. long: racemes many-fld., panicled at the ends of branches; corolla glabrous: pod narrow-oblong, glabrous or slightly pubescent, 6–10-seeded. June–Aug. Eu., W. Asia; naturalized in some places E. B.B. (ed. 2) 2:350. S.E.B. 3:328. R.F.G. 22:2088. Var. **plèna,** Hort. With double fls. R.H. 1899, p. 573. G.W. 16, p. 137. Var. **virgàta,** Mert. & Koch (*G. virgàta,* Willd., not Link, not Lam. *G. elàta,* Wender.). Of more vigorous growth, to 6 ft. high: pod 3–6-seeded. S.E. Eu. Var. **humílior,** Schneid. (*G. mántica,* Poll.). Dwarf and compact, more pubescent: pods silky-villous. Italy.

FF. *Habit procumbent: fls. axillary.*

15. **pilósa,** Linn. Dwarf, procumbent or ascending: lvs. cuneate, oblong or obovate, dark green and almost glabrous above, silky beneath: fls. axillary, 1–2, often racemose toward the end of branches: pod linear, silky, 5–8-seeded. May, June. Cent. and S. Eu., W. Asia. S.E.B. 3:327. R.F.G. 22:2093.

BB. *Twigs broadly 2-winged.*

16. **sagittàlis,** Linn. (*Cýtisus sagittàlis,* Mert. & Koch). Dwarf, procumbent, with ascending or erect, mostly simple branches: lvs. ovate to oblong, villous: fls. in terminal, short racemes; corolla glabrous: pod linear-oblong, silky. May, June. Eu., W. Asia. R.F.G. 27:2081.

G. álba, Lam.=Cytisus multiflorus.—*G. Andreána,* Puissant=Cytisus scoparius var. Andreanus.—*G. ánglica,* Linn. Spiny shrub, to 3 ft., sometimes procumbent, glabrous: lvs. oval to linear-oblong, bluish green: racemes few-fld. Cent. Eu. S.E.B. 3:326. R.F.G. 22:2086.—*G. anxántica,* Tenore (G. tinctoria var. anxantica, Fiori). Allied to G. tinctoria. Dwarf, diffuse: lvs. elliptic, obtuse, glabrous: fls. in racemes. Italy.—*G. aspalathoídes,* Lam. Low, spiny shrub: lvs. simple or 3-foliolate: fls. 1–3, axillary, forming loose, terminal racemes: pod many-seeded. N. Afr.—*G. canariénsis,* Linn.=Cytisus canariensis.—*G. cándicans,* Linn.=Cytisus monspeliensis.—*G. dalmática,* Bartl. Allied to G. germanica. Spiny shrub with appressed or spreading silky pubescence: lvs. linear-lanceolate, simple: fls. in terminal racemes, 1–1½ in. long: pod globose-ovoid, 1-seeded. Dalmatia, Herzegoyina. B.M. 8075.—*G. formósa,* Hort.=Cytisus racemosus.—*G. glabréscens,* Briquet=Cytisus emeriflorus.—*G. hórrida,* DC. Spiny rigid shrub, to 1 ft.: lvs. opposite, usually 3-foliolate, pubescent: fls. 1–3, in terminal heads: pods rhombic-lanceolate, pubescent. S. France, Spain. G.C. III. 53:140.—*G. júncea,* Lam.=Spartium junceum.—*G. lusitánica,* Linn. Spiny shrub, 1–3 ft.: lvs. 3-foliolate; lfts. linear-lanceolate, silky, very small: fls. in peduncled heads. Spain, Portugal.—*G. nyssána,* Petrovich. Shrub, to 3 ft., silky-villous: lvs. 3-foliolate: fls. in terminal leafy racemes to 8 in. long: pod rhombic, villous, 2-seeded. Servia, Albania. I.T. 5:197.—*G. ováta,* Waldst. & Kit. Allied to G. tinctoria. To 1 ft., with ascending or erect branches: lvs. ovate to lanceolate, villous: pod villous. S. E. Eu. L.B.C. 5:482.—*G. prostráta,* Lam.=Cytisus decumbens.—*G. racemósa,* Hort.=Cytisus racemosus.—*G. radiáta,* Scop. Erect shrub, with opposite rigid branches: lvs. simple or 3-foliolate: fls. in 3–6-fld. heads: pod oval, silky. S. E. Eu. B.M. 2260.—*G. Retáma,* Nichols.=G. monosperma.—*G. scariósa,* Viv.=G. triangularis.—*G. scopária,* Lam.=Cytisus scoparius.—*G. triangulária,* Willd. Dwarf, with ascending or procumbent triangular branches, glabrous: lvs. obovate to lanceolate, with transparent margin: fls. in short racemes. Italy. S. E. Eu. L.B.C. 12:1135 (as G. scariosa).

ALFRED REHDER.

GENTIÀNA (after Gentius, King of Illyria, who is said to have discovered the tonic value of these plants). *Gentianàceæ.* Choice herbs, mostly blue-flowered, grown in the open, many of them in alpine gardening.

Chiefly perennial herbs, only rarely biennial or annual, often dwarf, diffuse or frequently tufted, sometimes erect and slender or even tall and stout: lvs. opposite, rarely verticillate, mostly sessile: fls. blue, violet, purple, rarely dull yellow or white; floral parts typically 5, rarely 4–7: fr. a caps.—There are about 300 species, widely scattered in temperate and mountainous regions. Many botanists now consider the genus in a highly restricted sense, taking up various names for gentians, such as Amarella, Dasystephana, and so on, but they are here all considered as of the genus Gentiana.

Gentians are amongst the most desirable of alpine plants, and of blue flowers in general, but they are usually considered difficult to establish. The genus is the largest in the family, and from the horticultural standpoint, the most important.

The blue gentian, celebrated by tourists in the Alps, is mostly the stemless *G. acaulis.* This was brought to English gardens so long ago that all record of its introduction is lost. It is by far the most popular kind in cultivation. This species is by some split into five distinct forms, of which *G. angustifolia,* Vill. (not Michx.), is nearest to the Gentianella of English gardens. It has been so much modified in cultivation that it now has stems 4 to 6 inches high and the rootstock is so stoloniferous that the plant has to be cut back every year when used for edgings in English gardens. In France it is easily grown in a compost of one-half humus or leaf-soil and one-half good vegetable mold, to which may be added a little sand. Correvon writes: "It can be multiplied by means of offsets, but it is infinitely better to raise it from seed, and, in doing this, it should not be forgotten that the seeds of this group of gentians are very tedious, and, more especially, very capricious in germinating. I have sown seeds of *G. acaulis,* some of which did not germinate for twelve months, while others (which I must say were more recently gathered) germinated in a few weeks. The seedlings should be potted as soon as possible and while they are very young. They will begin to flower in about three years from the time of sowing, rarely sooner." Except *G. Andrewsii, G. Saponaria* and *G. puberula,* and perhaps a few others, gentians do not thrive so well in America as in England. Our seasons are too hot and dry. Whenever possible, choose a damp atmosphere.

It is rash to generalize on gentian-culture, because some plants are tall, others dwarf, some found on mountains, others in lowlands, some in moist soil, others in dry lands, while some like limestone and others cannot endure it. The annual kinds are of interest only to the expert. Alpine plants in general are singular in requiring an extremely large water-supply, combined with extremely good drainage. Another difficult problem is to keep the plants as cool as they are on the mountains without shading them more than nature does. Gentian seeds are small, and in germination slow and uncertain. They should be sown as soon as gathered, for the thorough drying out of small seeds is, as a rule, soon fatal. Gentians are difficult to establish, and dislike division of the root, but are well worth patient years of trial, for they are very permanent when once established. Nature-like alpine gardens are one of the latest

and most refined departments of gardening, and gentians are one of the most inviting groups of plants to the skilled amateur. Consult *Alpine Plants*.

There are several fringed gentians, but ours (*G. crinita*, Fig. 1625) is perhaps the most beautiful of gentians, and one of the choicest and most delicate of American wild flowers. It has been proposed as our national flower, and, while sought after less than the trailing arbutus, it is in even greater danger of extermination in certain states because it is a biennial, and because it has never been successfully cultivated. Seeds of *G. crinita* have long been advertised, but they are difficult to germinate and the plant is not seen in American gardens. The fringed gentian is, however, firmly rooted in American literature, and from the time of Bryant's ode many tributes in verse have been paid to its unique beauty. The daily unfolding of its square-ridged and twisted buds has been watched in thousands of homes. By the artists its blue is often considered the nearest approach to the color of the sky, but it must be confessed that a shade of purple often appears in the older flowers.

1625. Gentiana crinita. (×⅓)

Correvon makes four cultural groups of gentians:

1. *Tall gentians for general culture:* species whose roots are more or less stout, which are of relatively easy culture, and therefore suitable for borders, rockwork and landscape gardening. Typical plant, *G. lutea;* others are *G. affinis, G. alba, G. Andrewsii, G. asclepiadea, G. Bigelovii, G. Burseri, G. Cruciata, G. decumbens, G. Fetisowii, G. gelida, G. Kesselringii, G. macrophylla, G. Olivieri, G. Pneumonanthe, G. Porphyrio, G. Saponaria, G. sceptrum, G. septemfida* and *G. Walujewi.*

2. *Low-growing gentians:* species whose roots being less stout are adapted to rockwork, and for the open ground only when a special compost is provided. Includes *G. acaulis* and the species into which it is sometimes divided.

3. *Tufted gentians:* species with sessile flowers growing little above the level of the ground, and suited to the same positions as Group II. Typical plant, *G. verna:* others are *G. bavarica, G. imbricata, G. oregana, G. ornata, G. pyrenaica,* and *G. pumila.*

4. *Rare gentians:* species which cannot be grown without some special knowledge and practical experience. Typical plant, *G. purpurea;* others are *G. ciliata, G. Froelichii, G. punctata,* and presumably all the rest.

The two most popular gentians in American cultivation seem to be *G. acaulis* and *G. Andrewsii.* These are perhaps, followed by *G. Cruciata, G. puberula* and *G. Saponaria.* The plant which King Gentius knew is probably *G. lutea,* the root of which furnishes the gentian of drugstores. From the same sources comes the liqueur or cordial called "gentiane."

In the index, those marked with an asterisk (*) appear in American trade catalogues; the others are cultivated abroad. (See also Suppl. list, p. 1328). The plants are perennials and mountain-loving, unless otherwise stated.

INDEX.

*acaulis, 51.
adscendens, 3.
affinis, 29.
alata, 48.
*alba, 7, 19, 51.
algida, 10, 11.
alpina, 55.
*Andrewsii, 22.
angulosa, 48.
*angustifolia, 31, 52.
*asclepiadea, 19.
barbata, 16.
bavarica, 49.
*Bigelovii, 39.
brevidens, 37.
Buergeri, 26.
Burseri, 2.
*calycosa, 35.
campestris, 12.
carpatica, 46.
Catesbæi, 21, 22.
ciliata, 15.
*Clusii, 54.
cordifolia, 28.
*crinita, 14.
*Cruciata, 45.
dahurica, 30.
*decumbens, 3.
detonsa, 16.
dinarica, 56.
excisa, 51.
Favratii, 48.
Fortunei, 27.
Freyniana, 28.
frigida, 9, 10.
Froelichii, 18.
Gaudiniana, 43.
gelida, 11.
guttata, 20.
imbricata, 47.
incarnata, 8.
intermedia, 8.
Kochiana, 53.
Kochii, 51.
Kurroo, 37.
*linearis, 23.
*lutea, 1.
*macrophylla, 44.
Moorcroftiana, 13.
*Newberryi, 38.
nivalis, 46.
occidentalis, 17.
ochroleuca, 8.
Olivieri, 30.
*oregana, 40.
ornata, 32.
pannonica, 42.
*Parryi, 36.
Pneumonanthe, 20.
Porphyrio, 31.
prostrata, 25.
pseudo-Pneumonanthe, 23.
*puberula, 41.
pumila, 50.
*punctata, 6.
*purpurea, 4.
pyrenaica, 24.
quinqueflora, 17.
*quinquefolia, 17.
rubra, 5.
*Saponaria, 21.
*scabra, 26.
*sceptrum, 34.
*septemfida, 28.
serrata, 16.
Thomasii, 4.
triflora, 33.
Veitchiorum, 32.
verna, 48.
villosa, 8.

KEY TO THE SPECIES.

A. *Calyx spathe-like, split in two.*
  B. *Color of fls. yellowish.*
    C. *Form of corolla wheel-shaped* ..... 1. **lutea**
    CC. *Form of corolla club-shaped, at least in bud* ..... 2. **Burseri**
  BB. *Color of fls. blue or purple, at least above.*
    C. *Corolla plaited* ..... 3. **decumbens**
    CC. *Corolla not plaited.*
      D. *Anthers grown together* ..... 4. **purpurea**
      DD. *Anthers free* ..... 5. **rubra**
AA. *Calyx with a tubular portion, and usually 5 lobes.*
  B. *Color of fls. yellowish, or greenish white.*
    C. *Style distinct: caps. not stalked* .... 6. **punctata**
    CC. *Style none or very short: caps. stalked.*
      D. *Height 2 ft.* ..... 7. **alba**
      DD. *Height 9–12 in.* ..... 8. **villosa**
      DDD. *Height 6 in. or less.*
        E. *Lobes of calyx longer than the calyx-tube* ..... 9. **frigida**
        EE. *Lobes of calyx shorter than the calyx-tube.*
          F. *Lvs. lanceolate-linear* ..... 10. **algida**
          FF. *Lvs. ovate-lanceolate* ..... 11. **gelida**
  BB. *Color of fls. blue or purple.*
    C. *Corolla not plaited.*
      D. *Glands found at the base of the filaments.*
        E. *Calyx 4-cut* ..... 12. **campestris**
        EE. *Calyx 5-cut* ..... 13. **Moorcroftiana**
      DD. *Glands not found at the base of the filaments.*
        E. *Fringed gentians: calyx 4-cut.*
          F. *Caps. raised on a distinct stalk.*
            G. *Apex of lobes fringed, the sides less so* ..... 14. **crinita**
            GG. *Apex of lobes not fringed, base fringed* ..... 15. **ciliata**
          FF. *Caps. on a very short stalk* ... 16. **serrata**
        EE. *Not fringed: calyx 5-cut; corolla-lobes tipped with a sharp point* ..... 17. **quinquefolia**
    CC. *Corolla plaited.*
      D. *Stigmas 2, always distinct.*
        E. *Caps. finally raised on a distinct stalk.*
          F. *Anthers permanently grown together.*
            G. *Calyx as long as the corolla.* 18. **Froelichii**
            GG. *Calyx one-half or one-third as long as the corolla.*
              H. *Seeds not at all winged* .. 19. **asclepiadea**
              HH. *Seeds slightly winged.*
                I. *Fls. open* ..... 20. **Pneumonanthe**
                II. *Fls. closed, blue* ..... 21. **Saponaria**

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HHH. *Seeds strongly winged.*
I. *Fls. closed, purple*.....22. **Andrewsii**
II. *Fls. open*.....23. **linearis**
FF. *Anthers free, at least finally.*
G. *Number of corolla-lobes 10*.24. **pyrenaica**
GG. *Number of corolla-lobes 5 (rarely 4).*
H. *Calyx 4-lobed*.....25. **prostrata**
HH. *Calyx 5-lobed.*
I. *Lvs. distinctly rough above (hispid-scabrous)*.....26. **scabra**
II. *Lvs. distinctly rough at the margins (scabrous).*
J. *Lobes of calyx shorter than the calyx-tube*...27. **Fortunei**
JJ. *Lobes of calyx as long as the calyx-tube.*
K. *Corolla-lobes ovate, acute, a little longer than the much-cut appendages*.....28. **septemfida**
KK. *Corolla-lobes oblong-lanceolate, obtuse, thrice as long as the much-cut appendages*.....29. **affinis**
III. *Lvs. not distinctly rough above or at margins.*
J. *Seeds not at all winged.*
K. *Form of corolla-lobes linear-oblong*.....30. **Olivieri**
KK. *Form of corolla-lobes ovate, often broadly so.*
L. *Fls. solitary.*
M. *Peduncled*.....31. **Porphyrio**
MM. *Not peduncled*....32. **ornata**
LL. *Fls. in clusters of 3–5 or more.*
M. *Lvs. lanceolate-linear*.....33. **triflora**
MM. *Lvs. ovate to oblong-lanceolate.*
N. *Height 2–4 ft*.....34. **sceptrum**
NN. *Height 9–12 in.*
O. *Calyx-lobes ovate, about as long as the calyx-tube*....35. **calycosa**
OO. *Calyx-lobes linear, moderately or much shorter than the calyx-tube*.36. **Parryi**
JJ. *Seeds winged (at the base in G. Kurroo, in G. Bigelovii wings narrow, thickish).*
K. *Height 2–8 in.: fls. spotted.*
L. *Pedicel ½in. long or more*.....37. **Kurroo**
LL. *Pedicel very short, practically absent*..38. **Newberryi**
KK. *Height 1–2 ft.*
L. *Fls. in a dense spike*.39. **Bigelovii**
LL. *Fls. 1 to few or several.*
M. *Appendages conspicuous, sometimes nearly as long as the corolla-lobes*.....40. **oregana**
MM. *Appendages only half as long as the corolla-lobes*..41. **puberula**
EE. *Caps. sessile.*
F. *Anthers grown together; style distinct: seeds winged.*
G. *Calyx 5-cut, the lobes longer than the calyx-tube*.....42. **pannonica**
GG. *Calyx entire, truncate, indistinctly 5-lobed*.....43. **Gaudiniana**
FF. *Anthers free; style usually not distinct: seeds not winged.*
G. *Lvs. 6-12 in. long: calyx 5–6-lobed*.....44. **macrophylla**

GG. *Lvs. much shorter: calyx 4-lobed*.....45. **Cruciata**
DD. *Stigmas contiguous, rather funnel-shaped, the margin crenate-fimbriate.*
E. *Anthers free; style distinct.*
F. *Calyx pellucid, veiny*.....46. **carpatica**
FF. *Calyx leafy.*
G. *Seeds winged*.....47. **imbricata**
GG. *Seeds not winged.*
H. *Lvs. ovate*.....48. **verna**
HH. *Lvs. obovate*.....49. **bavarica**
HHH. *Lvs. linear*.....50. **pumila**
EE. *Anthers connate; style short.*
F. *Fls. spotted.*
G. *Color deep blue*.....51. **acaulis**
GG. *Color sky-blue*.....52. **angustifolia**
GGG. *Color violet-blue*.....53. **Kochiana**
FF. *Fls. not spotted.*
G. *Corolla broadly bell-shaped.*
H. *Size of fls. large*.....54. **Clusii**
HH. *Size of fls. small*.....55. **alpina**
GG. *Corolla almost cylindrical*...56. **dinarica**

1. **lûtea,** Linn. Fls. in dense, umbel-like cymes; corolla 5–6-parted; lobes oblong-linear, acuminate; anthers free; style none. July–Sept. Eu., Asia Minor. Gn. 64, p. 59. G.W. 3, p. 290.—Prop. only by seed. Sow seed in Nov. in coldframe. Seedlings appear the following March and April. In May and June prick them out under a coldframe, and in Aug. transfer young plants to pots, where they should be kept until needed for permanent outdoor use. Be very careful never to break the roots. Sometimes cult. abroad for medicine.

2. **Bûrseri,** Lapeyr. A low perennial, less than 1 ft., with a simple st.: lvs. elliptic-ovate, 7-nerved: corolla mostly 6-cut; the tube much longer than the limb; lobes ovate-oblong, acute; anthers connate; style distinct. June, July. Pyrenees.—Cult. like preceding.

3. **decúmbens,** Linn. f. (*G. adscéndens,* Pall.). A stout, erect herb with fl.-sts. 2–10 in. tall: lvs. mostly radical, oblong or elliptic, margins scabrous: fls. blue; calyx-tube ⅛in. long, often split nearly to the base; corolla narrowly obconical, toothed between the lobes; lobes 5, ovate; anthers connate, finally free. Himalayas, Tibet. June–Aug. B.M. 705, 723.—Cult. like *G. lutea.*

4. **purpûrea,** Linn. Lvs. ovate-oblong, 5-nerved: fls. purple above; corolla-tube yellowish, club-shaped; lobes mostly 6, obovate-subrotund, one-third the length of the tube. Aug., Sept. Eu. L.B.C. 6:583 shows a rich, dull purple, with no trace of blue.—Compost of sphagnum and heath soil. Be careful not to break the roots.

5. **rûbra,** Clairv. (*G. Thómasii,* Gillaboz). One of 5 or more natural hybrids between *G. lutea* and some species of the section Cœlanthe, which includes *G. punctata, G. purpurea, G. Pannonica,* and *G. Burseri:* fls. purplish outside. Swiss Alps.

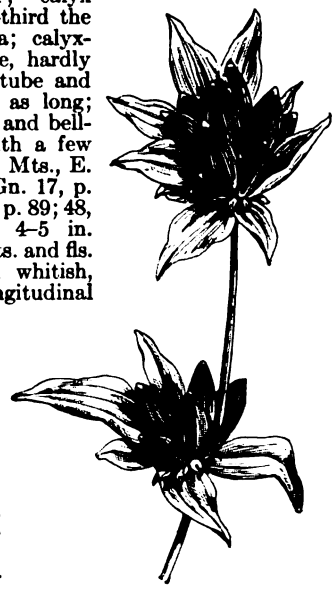
6. **punctàta,** Linn. Lvs. 5-nerved: calyx 5–7-cut; corolla-tube bell-shaped; lobes ovate, muticous, one-third the length of the tube; anthers finally free. Cent. Eu.—The spots are not arranged in any definite order. This belongs to the section Cœlanthe, in which the seed has a wing of the same color, while the next 5 species belong to the section Pneumonanthe, in which there is no wing, or it is of a different color. Cult. like *G. Froelichii.*

7. **álba,** Muhl. St. stout: lvs. acuminate, with a clasping base: fls. in a terminal head, with single or clustered ones in the upper axils; dull white, commonly tinged yellowish or greenish; corolla resembling *G. Saponaria,* but more bell-shaped and open; lobes ovate, short, little if at all spreading. Low grounds and mountain meadows, N. Amer. B.M. 1551 (as *G. ochroleuca*). —This species now takes the name **G. flávida,** Gray.

8. **villòsa,** Linn. (*G. ochroleùca*, Froel.). St. smooth scending, simple or nearly so, slender, 6–18 in. tall: lvs. ovate-lanceolate and obovate: fls. in crowded terminal, nearly sessile, leafy clusters, or sometimes axillary; corolla yellowish white or greenish, club-shaped, connivent at the apex. E. N. Amer. Not B.M. 1551. Var. **intermèdia,** Griseb. (*G. intermèdia*, Sims, not L.B.C. 3:218), may be a hybrid between this and *G. Andrewsii*. It resembles *G. ochroleuca* in having calyx-lobes of unequal lengths, but as long as or longer than the calyx-tube, and free anthers: it resembles *G. Andrewsii* in the tinge of purplish blue. B.M. 2303. Var. **incarnàta,** Griseb. (*G. incarnàta*, Sims), B.M. 1856, from Carolina is not cult. These forms are not considered worthy of varietal rank in Gray's Syn. Fl.

9. **frígida,** Hænke. Lvs. spatulate-linear, obtuse: fls. 1 or 2 at the top, sometimes a few in the upper axils; calyx not laterally cut, and half as long as the corolla or more; calyx-teeth lanceolate, a little longer than the calyx-tube; corolla club-shaped, plaits not cut. Carpathian Mts.; also N. Amer.—This is the true type of *G. frigida*, which is not in cult., but is inserted to make clear the differences between *G. algida* of Pallas and of Steven.

10. **álgida,** Pall., not Stev. (*G. frígida* var. *álgida*, Griseb.). Lvs. lanceolate-linear: fls. 2–5 at the top and distinctly pedicelled; calyx laterally cut and one-third the length of the corolla; calyx-teeth linear-lanceolate, hardly as long as the calyx-tube and sometimes only half as long; corolla between club- and bell-shaped; plaits cut with a few crenate teeth. Altai Mts., E. Siberia, N. Amer. Gn. 17, p. 343, same as Gn. 27, p. 89; 48, p. 146.—This grows 4–5 in. high, has numerous sts. and fls. nearly 2½ in. long, whitish, with blue spots in longitudinal lines.



1626. Gentiana Andrewsii.

11. **gélida,** Bieb. (*G. álgida*, Stev., not Pall.). Lvs. ovate-lanceolate, 3-nerved: fls. few and terminal, or many in the upper axils, peduncled; calyx-teeth linear-oblong, acute, nearly as long as the calyx-tube or shorter than it; corolla rather bell-shaped, yellowish white, its lobes broadly ovate, twice as long as the calyx and twice as long as the lacerated plaits. June, July. Caucasus. Not P.M. 7:5, which is *G. septemfida* var. *cordifolia*.—"Light, deep, cool soil and full sunlight."—Correvon.

12. **campéstris,** Linn. A low slender annual with erect st. 2–6 in. tall: lvs. sessile, ovate-lanceolate, 3–5-nerved: fls. dark purplish blue, short-pedicelled, but in various kinds of clusters; calyx 4-cut; corolla nearly bowl-shaped, crowned; anthers free; style none. Eu.

13. **Moorcroftiàna,** Wall. A stiff annual 8–16 in. high: fls. pale blue in nearly terminal cymes which are racemosely clustered; calyx 5-cut; corolla funnel-shaped, about 1½ in. wide. Himalayas. B.M. 6727, where fls. are shown as pale purple.

14. **crinìta,** Froel. Fig. 1625. Fringed Gentian. Biennial or often annual: erect, branched, 1–2 ft. high: lvs. lanceolate or ovate-lanceolate, acutish, from a rounded or subcordate partly clasping base: corolla-lobes wedge-obovate: seeds roughened by scales or needle-like projections. Moist woods and meadows. N. Amer. B.M. 2031. Mn. 4:161. B.B. 2:613.—The ribs of the calyx (made by the decurrent lobes) are one of the minor beauties of this plant, and are probably more pronounced than in the other fringed gentians here described. Almost impossible to grow in cult.

15. **ciliàta,** Linn. Perennial: st. flexuose, scarcely branched: lvs. linear, obtuse: corolla-lobes obovate-oblong: seeds smooth. Dry limestone soils. Eu. Not B.M. 639, which is *G. serrata*.—Hardly 3 per cent of Correvon's seedlings have flowered. He recommends a heavy, compact soil which is almost clayey, and full sunlight.

16. **serràta,** Gunner (*G. barbàta*, Froel. *G. detónsa*, Griseb. *G. detónsa* var. *barbàta*, Griseb.). Annual: st. erect, branching, 3–18 in. high: lvs. linear or lance-linear: corolla-lobes oblong or spatulate-obovate, fringed around the apex and sides or sometimes either part nearly bare. Wet lands, Ural and Altai Mts., Caucasus, N. Amer. B.B. 2:614. B.M. 639 (erroneously as *G. ciliata*).—No plants appear to be advertised as *G. serrata*. *G. barbata* is a trade name abroad.

17. **quinquefòlia,** Linn. (*G. quinquefòra*, Hill, Lam. and others). Annual: height 1–2 ft., the larger plants branched: lvs. 3–7-nerved: infl. thyrsoid-paniculate; clusters 3–5-fld.; fls. bright blue; calyx one-fifth or one-fourth as long as the narrowly funnel-shaped corolla. N. Amer. Probably the form in cult. is var. **occidentàlis,** Gray. Height 2–3 ft., paniculately much branched: infl. more open; calyx half the length of the broader corolla. B.B. 2:615. B.M. 3496.—Very pretty.

18. **Froèlichii,** Jan. Sts. short, almost tufted: fls. blue, solitary, peduncled, nearly as long as the st.; corolla not spotted. Very rare in Alps, limestone rocks.—Easily grown on rockwork in compost of equal parts of sphagnum, heath soil and vegetable-mold. Half-exposure to sunlight.

19. **asclepiádea,** Linn. St. strict, about 1–1½ ft. tall: lvs. sessile, ovate-lanceolate: calyx-teeth very short: fls. in spike-like racemes, dark blue, very showy; corolla club-shaped; calyx one-third as long as the corolla: seeds not winged. July–Sept. S. Eu., Caucasus. B.M. 1078. Gn. 48, p. 143, and 54, p. 39. G.M. 47:544. Gt. 54, p. 345. G. 3:59; 8:481; 13:403; 21:233. Var. **álba,** a white-fld. form is excellent but perhaps not known outside of English trade. Shade or half-shade, and moist, deep soil rich in humus.

20. **Pneumonánthe,** Linn. St. erect: fls. dark blue in a cyme-like raceme (the top fls. opening first); corolla club-shaped; lobes ovate, acute, mucronate, much longer than the appendages. Aug.–Oct. Mountain marshes, Eu., N. Asia. Var. **guttàta,** Sims, is dotted white. B.M. 1101.—"Requires a cool, deep, spongy soil, rich in humus. Dislikes lime, and prefers sandy soil. Does remarkably well when planted on margins of ponds or brooks. Prop. by seed or division."—Correvon.

21. **Saponària,** Linn. (*G. Catésbæi*, Walt., not Andr.). Barrel or Soapwort Gentian. St. ascending: fls. light blue, club-shaped; calyx-lobes linear or oblong, mostly as long as the calyx-tube; corolla-lobes short, broad, roundish, erect, little, and often not at all longer than the 2-cleft and many-toothed intervening appendages. N. Amer. B.M. 1039. (Hooker is probably wrong in referring this picture to *G. Andrewsii*, although the calyx-lobes in the plate are not narrow enough.)—Cult. like preceding.

22. **Andrewsii,** Griseb. (*G. Catésbæi*, Andr., not Walt.). Closed, Blind or Bottle Gentian. Fig. 1626. St. ascending: fls. purplish blue; calyx-lobes lanceolate to ovate, usually spreading or recurved, shorter than the calyx-tube; corolla-lobes entirely obliterated, the teeth at the top being supposed to be the remains of the

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XLVII. Gentiana crinita.

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appendages often found between the corolla-lobes in other species. July, Aug. Moist places. E. N. Amer. B.M. 6421. B.B. 2:616. Gn. 27:86. G.W. 4, p. 549. F.W. 1879:33. L.B.C. 9:815 (erroneously as *G. Saponaria*).—A white-fld. form is cult. but very rare. For cult., see *G. Pneumonanthe*.

23. **lineàris,** Froel. (*G. pseùdo-Pneumonánthe,* Schult.). St. strict, 1–2 ft. high: fls. blue, 1–5 in the terminal cluster; corolla narrowly funnel-shaped; lobes erect, roundish ovate, obtuse, a little longer than the triangular, acute, entire or 1–2-toothed appendages. Bogs, N. Amer. B.B. 2:617.

24. **pyrenàica,** Linn. St. tufted, about as long as the fl., often forming mats: lvs. with a cartilaginous, scabrous margin: fls. solitary, dark blue; corolla funnel- or nearly bowl-shaped, as long as or exceeding the corolla which is about 1 in. long. May, June. Eu., Asia Minor. B.M. 5742.—Very distinct and dainty. Cult. like *G. verna*.

25. **prostràta,** Hænke (*Chondrophýlla americàna,* Nelson). Annual, dwarf: lvs. white-margined: fls. azure-blue, solitary and terminal, the parts in 4's; corolla salver-form, in fruit inclosing the long-stalked caps. W. N. Amer. Alpine.

26. **scàbra,** Bunge. St. erect, leafy, rough-hairy above: basal lvs. almost perfoliate, ovate, acute, faintly 3-nerved, the margins rough toothed: fls. dark blue, clustered; corolla bell-shaped. E. Asia. *G. Fortunei* is considered a variety by recent authorities. (G.C. III. 47:136). Var. **Buérgeri** (*G. Buérgeri,* Miq.) is advertised by Yokohama Nursery Co. It differs in having a narrower corolla with shorter and more triangular lobes. Probably not in Amer. except in botanic gardens.

27. **Fórtunei,** Hook. Lvs. rather distant, 3-nerved: terminal fls. rather clustered; corolla-lobes blue, spotted white; outside of tube green; plaits blue, terminated by 3-toothed appendages, much shorter than the corolla-lobes. China. B.M. 4776. F.S. 9:947. I.H. 1:36.—Now thought to be a variety of *G. scabra*, but not so considered by Miquel.

28. **septémfida,** Pall. Lvs. lanceolate ("ovate," according to Grisebach), 3–5-nerved: fls. dark blue, in head-like cymes; calyx-lobes linear; corolla club-shaped. July–Oct. N. Asia, Orient. B.M. 1229 and 1410 (both purple outside and dotted brown within; the lobes of the latter spotted white). G. 34:773. L.B.C. 1:89. Gn. 54, p. 37. P.M. 8:51. Not F.S. 8:765. *G. Freyniàna*, Hort., is said to differ from the type in having larger fls. which are less prominently fringed between the segms. of the corolla. G.C. III. 46:202. Gn. 75, p. 421; 77, p. 168. Var. **cordifòlia,** Boiss. (*G. cordifòlia,* C. Koch), has heart-shaped lvs.: corolla-tube greenish white outside, unspotted within; lobes narrower, unspotted. B.M. 6497. P.M. 7:5 (erroneously as *G. gelida*).—The name septemfida is misleading, as 7-lobed corollas are very rare. Cult. like *G. lutea*.

29. **affinis,** Griseb. Sts. clustered, 3–9 in. high: lower lvs. obovate-oblong; upper lvs. lanceolate, acutish: fls. dark blue, in thyrsoid-racemose clusters, a few or sometimes solitary; calyx-lobes oblong-linear and sharp-pointed; corolla narrowly obconical, open, the lobes spreading. N. W. Amer. Gn. 46, p. 77 and 48, p. 139. B.B. 2:615 (where corolla-lobes are pictured erect, but said to be spreading).—Cult. like *G. Pneumonanthe*.

30. **Olivièri,** Griseb. (*G. dahùrica,* Fisch., which is probably the oldest name). Fls. dark blue, in umbel-like cymes; corolla narrowly obconical; plaits triangular, nearly entire. June–Aug. Mountain pastures, Asia.—By recent authority referred to *G. decumbens*, but differing from that species only in having equal calyx-lobes. Cult. like *G. lutea*.—Useful in the rockery, but will not grow well in the hot dry summer of E. U. S.

31. **Porphýrio,** J. F. Gmel. (*G. angustifòlia,* Michx., not Vill.). Lvs. narrowly linear: fls. blue, somewhat brown-dotted (also a snow-white variety with a greenish hue outside); corolla funnel-shaped; anthers connivent but never connected. July, Aug. Moist pine-barrens, N. Amer. B.B. 2:618.—Cult. like *G. Pneumonanthe*.

32. **ornàta,** Wall. Branches many from the same root: lvs. broadly linear: fls. solitary, blue, streaked; calyx-lobes spreading; corolla ventricose, about 1–1¾ in. long; lobes very short, spreading. Himalayas. B.M. 6514 and 8140. G.C. II. 20:396; III. 46:179. Gn. 59, p. 249.—A form that differs from the type in being more robust, with larger fls. and broader corolla-lobes which are "intense blue," is offered as *G. Veitchiòrum*, Hemsl. It is a native of W. China, "where it covers large areas," according to E. H. Wilson (Naturalist in Western China, 1:139), its discoverer. Intro. into England in 1904. Alpine. Gn. 73, p. 479. G.C. III. 46:178.

33. **trifìda,** Pall. St. erect: lvs. oblong-linear, blunt: fls. solitary, dark blue, the calyx 5-toothed, acute, and elongate; corolla club-shaped or bell-shaped, the anthers free. E. Siberia.—Probably not now in cult. in Amer. outside of botanic gardens.

34. **scéptrum,** Griseb. An erect, leafy perennial, from 2–4 ft. high: lvs. oblong-lanceolate: fls. dark blue; corolla bell-shaped, about 1 in. long: seeds winged on one side according to Grisebach, but Gray says not winged. Aug., Sept. N. W. Amer.—Cult. like *G. lutea*, except that it requires half shade and a rather peaty soil.

35. **calycòsa,** Griseb. About 1 ft. high: lvs. ovate, about ¾in. long, the 2 upper commonly involucrate around the fl.: fls. dark blue, commonly solitary, according to Gray; corolla oblong-funnel-shaped; appendages triangular-awl-shaped, laciniate or 2-cleft at the tip. N. W. Amer. G.M. 47:541.

36. **Párryi,** Engelm. Sts. many, from a rather woody root, about 9 in. tall: lvs. somewhat glaucous, ovate to oblong-lanceolate, the upper pairs involucrate around the 1–5 purple-blue fls.: appendages narrow, deeply 2-cleft. N. W. Amer.

37. **Kurroò,** Royle. St. tufted, as high as 7 in.: lower lvs. lanceolate, upper linear: fls. blue, spotted white inside, 1–3 on a st.; corolla bell-shaped. Himalayas. Gn. 17:264. B.M. 6470. Var. **brévidens** has shorter calyx-lobes. J.H. III. 30:3.

38. **Néwberryi,** Gray. St. 2–4 in. high: lower lvs. obovate or spatulate: fls. pale blue, white inside, greenish dotted; calyx-lobes oblong or lanceolate, nearly as long as the tube; corolla broadly funnel-shaped, its lobes ovate and sharp-pointed. N.W. Amer. Alpine.

39. **Bigelovii,** Gray. St. 6–16 in. high, equally leafy to the summit: fls. purple; corolla more narrowly funnelform and smaller than in *G. affinis*. July, Aug. New Mex., Colo. B.M. 6874.—"Soon forms large clumps, often with 40–50 sts. from a single plant, each bearing 10–20 bright blue fls."—D. M. Andrews.

40. **oregàna,** Engelm. Height 1–2 ft.: lvs. ovate or ovate-oblong, 1–1½ in. long: fls. blue, a few at the summit or several and loosely racemose; corolla broadly funnel-shaped, over 1 in. long; lobes short, roundish. July, Aug. N. W. Amer.

41. **pubérula,** Michx. Perennial, usually solitary-stemmed herb from 8–18 in. tall: lvs. oblong-lanceolate to lanceolate-linear: fls. blue, sessile or nearly so in the upper axils; corolla open-funnel-shaped, 1½–2 in. long; lobes ovate. E. N. Amer. B.B. 2:615.

42. **pannónica,** Scop. A tall stout perennial: lower lvs. broadly elliptical, 5-nerved, margin scabrous; upper ones ovate-lanceolate, also 5-nerved: fls. purple above; calyx 5–7-cut; corolla leathery, distinctly spotted; anthers connate at first, finally free. Eu.

43. **Gaudiniàna,** Thom. Natural hybrid with the habit of *G. purpurea*, but the membranous corolla of *G. punctata:* fls. rosy violet. Eu., but not widely cult.

44. **macrophýlla,** Pall. Perennial, with erect or ascending st.: lvs. lanceolate, distant, very spreading, 3-nerved, the upper often connate-perfoliate; internodes unequal: fls. dark blue. July, Aug. B.M. 1414, not L.B.C. 3:218. N. Eu. and Asia.—Cult. like *G. lutea.*

45. **Cruciàta,** Linn. (*Cruciàta verticillàta*, Gilib.). An erect and leafy perennial: lvs. ovate-lanceolate, crowded, erect-spreading, the upper connate-perfoliate; internodes equal: fls. axillary, in sparse clusters, dark blue. June–Aug. Eu., N. Asia.—Cult. like *G. lutea.* Prefers limestone and full sunlight.

46. **carpática,** Kit. (Probably *G. nivàlis*, Linn.). A slender perennial with small obovate lvs.: fls. solitary, axillary or terminal, dark blue (as are the next 4 species); corolla funnel-shaped, scarcely exceeding ¾in. long. Carpathian Mts.—Little known.

47. **imbricàta,** Froel. Lvs. acute, margins scabrous, (the next 3 species with smooth margins): corolla-lobes subrotund. June, July. Limestone rocks, Alps.—In this and the next 3 species, the corolla-lobes are usually crenate, half the length of the tube, and 6 times the length of the plaits. "Eastern and granitic Alps."—Correvon. Cult. like *G. bavarica.*

48. **vérna,** Linn. Fig. 1627. Tufted: st. angled: lvs. ovate or ovate-lanceolate: fls. solitary; calyx membranaceous; corolla nearly bowl-shaped; lobes ovate, obtuse. Apr.–June. Eu., Caucasus. B.M. 491. L.B.C. 1:62. R.H. 1859, p. 250. Gn. 48, p. 139; 75, p. 284. G.C. II. 24:373. J.H. III. 52:58. G.W. 23:431. Var. **alàta,** Griseb. (*G. angulòsa*, Bieb.), is taller and has the nerves of the ventricose calyx produced into wings.—Rockwork, in a compost of heath-soil, finely crushed granite, and vegetable-mold, with full sunlight. A supposed hybrid between this and the following has been described as *G. Favràtii*, Hort. The plant is practically unknown in Amer.

49. **bavárica,** Linn. Calyx-lobes lanceolate; corolla funnel- or nearly bowl-shaped; lobes obovate, obtuse; ovary sessile: seeds not winged. May–Aug. Cent. Eu. F.S. 7:651. L.B.C. 13:1256. J.H. III. 35:585. Gn. 15:278 (poor).—The pictures cited all show a salver-shaped corolla. "Requires a soil that is peaty, or at the very least porous and cool, well drained, and capable of retaining an abundant supply of moisture, although it may be fully exposed to the sun. In the alpine garden here we grow them in pure sphagnum moss on a wall facing due south, but the plants which we raise for sale are grown in pots in a compost of sphagnum, heath-soil and sand. Finest of Group III."—Correvon.

1627. Gentiana verna. (×⅔)

50. **pûmila,** Jacq. A tiny almost moss-like gentian with a 3–4-angled st.: lvs. clustered, scarcely more than ½in. long: fls. solitary terminal; calyx-lobes linear; corolla deep blue, the lobes ovate, acute. June, July. Tyrolese and Carinthian Alps.

51. **acaûlis,** Linn. (*G. excìsa*, Presl.). GENTIANELLA. STEMLESS GENTIAN. Fig. 1628. By the botanists of continental Eu. this is often split up into the 4 or 5 following species. The plants that Linnæus had in mind were probably mostly *G. Clusii* and *G. Kochiana.* For pictures of *G. acaulis* in its widest sense, see B. M. 52. G.C. III. 15:236. G.W. 3, p. 289. J.H. III. 52:59. R.B. 28:204. Gn. 48, p. 146; 54, p. 39. F.S. 23:2421, where a more detailed account of the 4 following species

1628. Gentiana acaulis.

is given. A var. **Kòchii,** Hort., is known but it may well be *G. Kochiana.* A white-fld. form, var. **álba,** is advertised.

52. **angustifòlia,** Vill., not Michx. Stoloniferous: lvs. linear-oblong, narrowing toward the base, glistening above: fls. spotted with sprightly green; calyx-lobes more or less spreading, oval, abruptly contracted at the base. May, June. Limestone rocks, Alps.—Considered by Correvon the handsomest species of the whole genus.

53. **Kochiàna,** Perr. & Song. Lvs. large, flat, thin, spreading, oval or broadly oblong, light green: calyx-lobes oblong, limp, more or less contracted at the base and separated by truncate sinuses; corolla with 5 blackish green spots on the throat. May, June. Common in pastures on granitic Alps.—Dislikes lime. It seems almost certain that this is the *G. acaulis* var. *Kochii* of many gardeners.

54. **Clûsii,** Perr. & Song. A low acaulescent perennial perhaps not different from *G. acaulis* and so considered in "Index Kewensis:" lvs. lanceolate-acute, leathery: fls. dark blue; calyx-lobes pressed close against corolla, not contracted at base, and separated by acute sinuses. May, June. Limestone rocks, Alps.

55. **alpìna,** Vill. St. almost wanting: lvs. small, glistening, curving inward and imbricated, forming rosettes which incurve at about the middle: fls. dark blue. May, June. Granitic Alps.—This and *G. Kochiana* "require a compost of one-third crushed granite, one-third heath soil, and one-third vegetable loam, and should be planted on rockwork half exposed to the sun."

56. **dinárica,** Beck. Lvs. broad, thick, erect: fls. dark blue. Certainly a mere form of *G. acaulis*, but described as differing from that species in having no spots on the corolla. Alps of S. and E. Austria.

The following are names of gentians not sufficiently described for insertion above or as yet scarcely known in cult.: *G. arverneńsis*, Hort. Perhaps a var. of G. Pneumonanthe. Fls. Napoleon blue. See G.C. II. 20:40, desc. G. 29:7.—*G. Charpentièri*, Thom. Natural hybrid, intermediate between G. lutea and G. punctata: corolla spotted red; calyx 5-cut. Grisebach does not say whether the corolla is not plaited, anthers always free, and style none. Alps, above Engadine.—*G. corymbìfera*, Hort., is described as 12–18 in. high, with usually simple sts. branching toward the top: fls. white, about 1 in. diam. New Zeal. G.C. III. 46:203.—*G. Fetisòwii*, Regel. St. erect, tall: fls. deep blue. China. Gt. 31:1069.—*G. Hénçsii*, Hausm.=G. Kummeriana.—*G. Késselringii*, Regel. Height about 8 in.: fls. whitish, dotted violet outside. Turkestan. Gt. 31:1087.—*G. Kummeriàna*, Sendt. Hybrid between G. lutea and G. Pannonica. Fls. yellowish.—*G. Làwrencei*, Burkill. Allied to G. ornata but distinguished by the much longer linear lvs.: corolla about 1¾ in. long, blue above, the tube paler with dark blue lines. Mongolia. G.C. III. 38:307.—*G. Wallichiàna.*—Height 8–12 in.: fls. clear blue.—*G. Walujéwi*, Regel & Schmalh. Fls. whitish, dotted pale blue. Turkestan. Gt. 33:1140.

WILHELM MILLER.
N. TAYLOR.†

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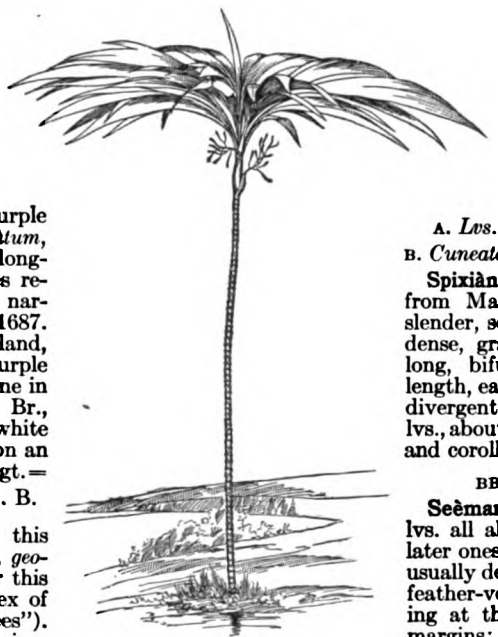
GENUS, pl. **GENERA** (i. e., *kind*), is a term used in natural history to designate a group of species. As with species, so the genus is an indefinite conception, varying with the author. The chief value of the conception is its use in aiding us conveniently to arrange and name plants and animals. The name of the genus is the first of the two words in the name of the plant: thus, in *Brassica oleracea*, Brassica designates the genus, and oleracea the particular Brassica of which we are speaking. It is difficult to trace the origin of the genus-conception in natural history, but it is usually ascribed to Konrad Gesner (Zurich, 1516–1565). L. H. B.

GEODÒRUM (*gift of the earth*). *Orchidàceæ*. Orchids of minor importance, E. Indies to Austral., with radical lanceolate or elliptical lvs., tuberous bulb-like rootstocks, and vari-colored fls. in a nodding spike on the top of the scape; sepals and petals similar, lip upright: terrestrial. Belongs in the same sub-group or tribe as Cyrtopodium and Eulophia. In habit, they somewhat resemble Phaius and Eulophia, and require similar treatment, with potting in fibrous loam and peat. Apparently not offered in this country, but sometimes grown abroad in collections. *G. purpùreum*, R. Br., from India: like a Bletia in habit: lvs. large: scape erect, bearing a densely-fld. drooping raceme; fls. small, white with purple markings on the lip. *G. fucàtum*, Lindl., of Ceylon: 1 ft.: lvs. oblong-lanceolate and plicate, the scapes recurved at the apex: fl. with pink narrow sepals and ovate lip. B.R. 1687. *G. pictum*, Lindl., from New Holland, grows 1–2 ft., with dull rose-purple fls. shaded brown and white, borne in dense racemes. *G. dilatàtum*, R. Br., of India, 6–12 in. high, fls. white marked pink and yellow, borne on an erect scape.—*G. plicàtum*, Voigt.= Phaius. L. H. B.

GEÒNOMA (Wittstein gives this interesting explanation: "Greek, *geonomos*, skilled in agriculture: for this tree puts forth buds at the apex of its stem which become new trees"). *Palmàceæ*, tribe *Arèceæ*. Slender spineless palms with ringed, reed-like stems much cultivated for their excellent decorative possibilities.



1629. Geonoma Spixiana.

Leaves terminal or alternate, usually crowded in showy clusters; blade entire, 2-lobed at the apex, or more or less pinnatisect; segms. acuminate, 1-nerved, with the margins broadly recurved at the base; rachis acute above, convex on the back; petiole nearly cylindrical, concave at the base above; sheath tubular: spadices ascending or recurved, simple, forked or paniculately branched, slender or stout, often colored; spathes 2, often deciduous before flowering, or obsolete, the lower one partial, truncate, concave, the upper compressed or fusiform; fls. monœcious in each spadix, borne in the furrows of the spadix, at length partially exserted, when in 3's the upper one pistillate; cells of the anthers twisted: fr. small, globose, black.—Species about 100. Trop. Amer. G.C. II. 24:586. A.G. 16: 345. For *G. Ghiesbreghtiana*, see *Calyptrogyne*.

Several of the members of this extensive genus of small-growing palms are useful for the greenhouse, though most attractive while in a small state, from the fact that geonomas soon begin to form a stem, and when aged become rather scantily furnished specimens. These palms are by no means difficult to grow, and do not require a very high temperature, their natural habitat being the mountains of Central and South America, some of the species being found at an altitude of over 4,000 feet above sea-level. Geonomas form part of the undergrowth on their native mountains, and are said never to appear in the open country unsheltered by trees of larger growth; therefore, shade is necessary for them when cultivated under glass. The old practice of growing geonomas in a very light peaty soil does not seem to be the only method, for excellent results have been secured by growing them in a good loam, well manured and well drained, giving an abundance of water and a night temperature of 60.° Red spiders and thrips are the most troublesome insects to which these plants are subject, and both of these pests multiply much more rapidly if the plants are kept too warm and dry. (W. H. Taplin.)

The most useful species from a commercial point of view is *G. Riedeliana* (*G. gracilis*), which reminds one of *Cocos Weddelliana*, but has longer leaflets. The species are undoubtedly confused under cultivation, and often unidentified. They are said not to be grown in the open in southern California, at least, not to any extent. The species here listed appear to be those of most horticultural importance here.

A. *Lvs. simple, 2-lobed at the apex.*

B. *Cuneate-oblanceolate, rusty, tomentose.*

Spixiàna, Mart. Fig. 1629 (adapted from Martius' work on palms). St. slender, solitary, 6–9 ft. high: lvs. in a dense, graceful cluster; blades 3–5 ft. long, bifurcate one-fourth of their length, each lobe lanceolate-acuminate, divergent: spadix from between the lvs., about 3 ft. long; fls. small, the calyx and corolla equal. W. Brazil.

BB. *Cuneate-ovate, plicate.*

Seèmannii, Hort. Low, 1–3 ft. high: lvs. all alike, the first 2 in. long, the later ones 10 in. long, entire, or 2-lobed, usually deeply cleft at the apex, plaited, feather-veined; stalk triangular, sheathing at the base, with broad, scarious margins: fls. unknown. F.M. 1869:428. Cent. Amer.

AA. *Lvs. pinnate.*

B. *Basal lf.-segms. narrow; the upper ones the broadest.*

acaùlis, Mart. Acaulescent: lvs. in a congested, rosette-like cluster, long-petioled, 3–4 ft. high; blade unequally pinnatisect, with usually 6 segms. on both sides of the rachis; 22–25-nerved, basal segms. 4 lines wide, spreading, the middle and upper erect-spreading at an acute angle, ¾–4 in. wide, the apical very wide: spadix stiff, usually about 18 in. long, the stalk very thick; fls. numerous: fr. unknown. Cent. Brazil.

BB. *Broad and narrow segms. irregularly intermingled.*

C. *Blade of lf. 6 ft. long; petiole 1 ft. long.*

Pohliàna, Mart. St. 12–15 ft. high, slender, densely ringed, columnar or reedy: lvs. very numerous, erect or spreading, forming a much congested, showy cluster, in adult specimens; segms. very unequal, linear-lanceolate, falcate-acuminate, few-nerved and many-nerved intermixed, 16–20 in. long; petioles very short: spadix scarcely showing among the dense cluster of lvs. Trop. Brazil.—Cult. most advantageously in a warm moist house. The young specimens are attractive for potted plants.

cc. *Blade 2–2½ ft.; petiole 4 in. long.*

élegans, Mart., var. **robústa,** Drude. St. 6–10 ft. high, 3–4 lines diam.: segms. rarely 3, usually 5–7, 1-nerved, 10–14 in. long, some 4 lines wide, intermixed with broader, many-nerved ones, all long, falcate-acuminate: spadix about 10 in. long, the fls. very small, inserted in deep pits. Cent. Brazil.

BBB. *Lf.-segms. all alike (except the connivent apical ones).*

c. *Alternate, remote, linear, scurfy.*

Riedeliàna, Wendl. (*G. grácilis,* Lind. & André, the oldest and perhaps the correct name). Habit of *Cocos Weddelliana,* the whole plant sparsely covered with caducous, brown, shining scales: petiole slender, 1½ ft. or more long, terete below, flattened above; rachis triangular, bisulcate above: lvs. spreading, drooping at the apex; segms. 10–12 in. long, about 9 lines wide, linear-acute, elegantly recurved, the 2 terminal ones connivent: fls. showy, yellow, in long drooping spadices. Brazil. I.H. 21:169. B.M. 7963.

cc. *Equidistant: petiole half as long as the blade.*

Schottiàna, Mart. St. 9–15 ft. high, 1–1¼ in. thick: lvs. long-stalked, gracefully recurving; petiole half or more than half as long as the blade; segms. about 35 on each side, 10–12 in. long, ⅔in. wide, equidistant, linear or linear-lanceolate, very long-acuminate, recurved at the tip: spadix about 10 in. long, the stalk about 1 ft. long. E. Brazil.—A very variable species.

The following are imperfectly described, but are in the trade: *G. imperiàlis,* Lind. G.W. 2, p. 37.—*G. princeps,* Lind.—*G. Pynærtiàna,* Hort. Belongs under A. One of the smallest lvs. measures 28 in. long by 10 in. at the broadest. Has not flowered yet, and the genus is therefore uncertain. R.H. 1898, p. 262. G.C. III. 23:258. F.E. 10:886. G.W. 2, p. 445.—*G. speciòsa,* Barb.-Rodr. G.W. 2, p. 431.—*G. Swàrtzii,* Griseb. (Calyptrogyne Swartzii, Hook. Calyptronoma Swartzii, Griseb.). Trunk 50–60 ft. high, smooth: lf.-segms. linear-acuminate, green, glabrous. Cuba.

N. TAYLOR.†

GEORGÌNA. A synonym of Dahlia, which still survives in the form of "Georginen," the popular name of dahlias in Germany.

GERÀNIUM (Greek, *crane;* from the resemblance of the fruit to a crane's bill). *Geraniàceæ.* CRANESBILL. Generally herbaceous plants, annual, biennial, and perennial. Widely cultivated in borders, and some species in the rockery, usually caulescent.

Leaves simple, alternate or opposite and much-lobed, sometimes almost radical: fls. regular; sepals 5, imbricated, often 3-nerved and mucronate; petals 5, often hairy or ciliate; stamens 10, in 2 rows; anthers 10; seeds when ripened separated from the ovary and with its awn bent sinuously. The genus Erodium, its nearest ally, has but the inner row of stamens furnished with anthers and the awn of the seed is bent spirally. The geraniums of common speech are classed in the genus Pelargonium, having at the side of the pedicel a distinct narrow tube and zygomorphic fls.—The genus Geranium has over 250 species, found in the temperate zones particularly of the northern hemispheres, very few in the tropics. The roots of some, as *G. maculatum,* find use in medicine on account of their astringency. Thrive well in ordinary garden soil, and are propagated by seeds and divisions of roots. The best botanical account is that of R. Knuth in Engler's Das Pflanzenreich, hft. 53 (1912), and by Small and Hanks in N. Amer. Flora, Vol. 25, 1907, for the N. American species. A beautifully illustrated account of the genus is by Sweet (1820–30) in which special stress is laid on cultivation. There are 500 colored plates, and, where possible, these are cited in the following account, thus, S. 197.=Sweet, Geraniaceæ, plate 197.

Large masses of native species such as *G. maculatum* and *G. Robertianum* can be effectively naturalized under bushes and trees. They spread very rapidly and in the case of *G. Robertianum* will be profuse bloomers nearly all summer.

INDEX.

aconitifolium, 10.
album, 13, 15, 16.
anemonifolium, 3.
argenteum, 6.
armenum, 14.
Backhousianum, 14.
canariense, 3.
cinereum, 7.
collinum, 24
endressii, 22.
erianthum, 17.
eriostemon, 18.
flore-pleno, 15.
Fremontii, 12.
grandiflorum, 20.
Grevilleanum, 25.
ibericum, 13.
incisum, 17.
lancastriense, 11.
Londesii, 24.
macrorrhizum, 5.
maculatum, 16.
malvæflorum, 4.
nepalense, 21.
phæum, 8.
platyanthum, 18.
platypetalum, 13.
plenum, 16.
pratense, 15.
prostratum, 11.
Richardsonii, 9.
Robertianum, 1.
sanguineum, 11.
sibiricum, 19.
subargenteum, 7.
Traversii, 2.
Wallichianum, 23.

KEY TO THE SPECIES.

A. *Plants annual, more or less prostrate: lvs. finely dissected* ..... 1. **Robertianum**
AA. *Plants perennial.*
B. *Species tender, to be grown only in greenhouse northward.*
C. *Foliage silvery canescent* ..... 2. **Traversii**
CC. *Foliage glabrous, at least never canescent* ..... 3. **anemonifolium**
BB. *Species hardy.*
C. *Tuberous-rooted* ..... 4. **malvæflorum**
CC. *Not tuberous-rooted.*
D. *Plant with a thickened woody base* ..... 5. **macrorrhizum**
DD. *Plants without thickened woody base.*
E. *Foliage silvery-canescent.*
F. *Usually 1-fld* ..... 6. **argenteum**
FF. *Usually 2-fld* ..... 7. **cinereum**
EE. *Foliage or whole plant glabrous or pubescent, but not silvery.*
F. *Sts. erect.*
G. *Fls. dark blue, almost black.* 8. **phæum**
GG. *Fls. not dark blue, sometimes light blue.*
H. *Color of fls. white (see also white-fld. forms of Nos. 13, 15, and 16).*
I. *Lvs. 3–5-parted* ..... 9. **Richardsonii**
II. *Lvs. 7-parted* ..... 10. **aconitifolium**
HH. *Color of fls. not white.*
I. *Mostly 1-fld* ..... 11. **sanguineum**
II. *Mostly more than 1-fld.*
J. *The st. branched.*
K. *Fls. rose-purple* ..... 12. **Fremontii**
KK. *Fls. violet* ..... 13. **ibericum**
JJ. *The sts. essentially simple.*
K. *Lobes of the lvs. more or less rounded* ..... 14. **armenum**
KK. *Lobes of the lvs. ovate or lanceolate.*
L. *Pedicels recurved in fr.* ..... 15. **pratense**
LL. *Pedicels erect in fr.*
M. *The pedicels not glandular* ..... 16. **maculatum**
MM. *The pedicels glandular.*
N. *Lvs. finely cut.* 17. **incisum**
NN. *Lvs. 5-lobed* ... 18. **eriostemon**
FF. *Sts. decumbent or creeping, scarcely erect.*
G. *Peduncles 1-fld* ..... 19. **sibiricum**
GG. *Peduncles 2- or more-fld.*
H. *Petals about as long as the sepals.*
I. *Fls. pale lilac* ..... 20. **grandiflorum**
II. *Fls. rose-purple* ..... 21. **nepalense**
HH. *Petals 1–2 times the length of the sepals.*
I. *Upper lvs. 3-lobed* ..... 22. **Endressii**
II. *All the lvs. 5-lobed.*
J. *The petals striped* ..... 23. **Wallichianum**
JJ. *The petals not striped, sometimes spotted.*
K. *Base of petals ciliate.* 24. **collinum**
KK. *Base of petals pilose or glabrous* ..... 25. **Grevilleanum**

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1. **Robertiànum,** Linn. HERB ROBERT. RED ROBIN. About 9 in. high: lvs. thin, ovate-orbicular, 3–5-parted, with 3-fid. pinnatifid lobes: peduncles slender, 2-fld.; fls. small, bright crimson. June to Oct. Amer., Eu., Asia and N. Afr. B.B. 2:341.—For the rockery, in a moist soil and some shade, and will carpet the ground in a few seasons, from seed. Annual; or possibly biennial.

2. **Trâversii,** Hook. A silvery canescant herb 3–15 in. tall with a stout st.: lvs. beautiful silver-color, nearly round, 7-parted, the lobes wedge-shaped, and 3-parted: fls. large, often 1½ in. across; sepals broadly ovate, cuspidate, silvery; petals ovate or nearly round, pale rose, or sometimes white, much longer than the sepals. Chatham Isl.—Not hardy north of Washington and to be grown in temperate house. Little known in Amer. but a desirable greenhouse plant.

3. **anemonifòlium,** L'Her. (*G. canariénse,* Reut.). A stiff single-stemmed perennial from a thickened rootstock or tube: lvs. glabrous, round-ovate, 5-parted, the lobes finely dissected: fls. corymbose, the pedicels and calyx densely hairy; sepals oblong, mucronate, the mucro almost ½in. long; petals 2–3 times as long as the sepals, obovate, pale purple. Canary Isls. and Madeira. S. 244.—Must be grown in the temperate house, but doubtless hardy south of Washington.

4. **malvæflòrum,** Boiss. A usually 1-stemmed perennial, from a thickened tuber, not over 18 in. tall: lvs. long-petioled, 5–9-parted, the lobes finely dissected, hairy: fls. showy, the pedicels and peduncles densely hairy; sepals ovate-oblong, hairy; petals rose-purple, obcordate, the apex often emarginate, about twice as long as the sepals. Medit. Region.—Very doubtfully hardy north of Philadelphia.

5. **macrorrhìzum,** Linn. A large-rooted species, about 1½ ft. high, with a st. suffruticose at base: lvs. smooth, round, basal ones 5-lobed, cauline 3-lobed, toothed and often colored red: fls. in bunches at the end of the st.; calyx inflated; the sepals ovate and 3-nerved; petals spatulate and blood-red in color. May to July. S. Eu. B.M. 2420. S. 271.

1630. Geranium maculatum. (×½)

6. **argênteum,** Linn. SILVER-LEAVED CRANE'S-BILL. About 3 in. high: lvs. almost radical, on long petioles, 5–7-parted, with 3-fid linear lobes, both surfaces hoary: peduncles almost radical, 1- or 2-fld.; fls. large, pink, with darker veins; petals emarginate. Middle of June to Aug. Carnic Alps. B.M. 504. L.B.C. 10:948. S. 59.—One of the best for the rockery. Often acts as a biennial in New England.

7. **cinèreum,** Cav. (*G. subargénteum,* Lange). GRAY CRANE'S-BILL. Like *G. argenteum,* but 2-fld. and paler in color: lvs. not so hoary in appearance. June, July. Pyrenees.

8. **phæum,** Linn. About 2 ft. high, with upright, short-haired st., glandular above: lvs. 5–7-lobed and deeply toothed: peduncles 1–2-fld.; petals spreading, obovate, unequally notched and often with a small spur, very dark blue, almost black, with white spot at base of each petal. May, June. Cent. and W. Eu.

9. **Rìchardsonii,** Fisch. & Trautv. About 1½ ft. high: lvs. thin and terminal, lobe of the uppermost lvs. longer than the often greatly reduced lateral lobes: pedicels conspicuously glandular pubescent; fls. large, white or sometimes streaked with pink; petals with long white hairs on inner surface. Colo. and west.—Sts. and young growth tinged with red.

10. **aconitifòlium,** L'Her. St. usually simple, grooved, 10–20 in. tall, few-lvd.: lvs. more or less hairy, deeply 7-parted, kidney-shaped or orbicular, the lobes broadly ovate, deeply pinnatifid, the segms. mucronulate: fls. fragrant, loosely corymbose, the pedicels 2-fld.; sepals oblong or oblong-ovate, 3-nerved; petals white, obovate, the margins slightly wavy. Alpine or sub-alpine region of Eu. June.—Useful chiefly as rock-garden species.

11. **sanguíneum,** Linn. About 1½ ft. high, with st. occasionally forked, erect: lvs. all petiolate, mostly 7-parted, with 3–5-lobed linear lobules: peduncles long, mostly 1-fld.; fls. very large, blood-red. June to Aug. Eu.—One of the best species in cult.

Var. **lancastriénse,** With. (*G. prostràtum,* Cav.). A dwarfer form, smaller and with less deeply lobed foliage: fls. lighter in color and conspicuously veined purple.

12. **Frèmontii,** Torr. & Gray. A 1- or many-stemmed perennial: lvs. nearly round, palmately 5–7-parted, the lobes 3-toothed or sometimes crenate, slightly hairy: fls. large and showy, frequently 1–1½ in. across; sepals oblong, 3-nerved; petals pale rose-purple, obovate, toward the base densely ciliate. Rocky Mts. G. 29:191.—A handsome garden species. Not as yet much known in cult. in Amer. but a fine showy geranium for the hardy border. Blooms all summer.

13. **ibéricum,** Cav. IBERIAN CRANE'S-BILL. From 1–1½ ft. high: st. erect and leafless below, above dichotomously branched, villous: lvs. opposite, 5–7-parted, with deeply cut lobes and toothed lobules: fls. 1 in. across, in showy, open panicles, violet. July, Aug. Iberia. Gn. 71, p. 167. B.M. 1386. S. 84. Var. **álbum,** with white fls., is rare but known by some dealers.

Var. **platypétalum** (*G. platypétalum,* Fisch. & Mey.). Slightly shorter than the parent, with lvs. less deeply lobed and lobes less pointed: fls. deeper and richer in color, and also larger. G.M. 52:61. Gn. 76, p. 108. G. 3:293; 9:686.

14. **armènum,** Boiss. (*G. Backhousiànum,* Regel?). About 2½ ft. high, the lower part of the st. thickened and almost woody: lvs. radical, upright, orbicular, with 5 deep lobes: fls. about 1½ in. across, inclining to a dark crimson; petals dark spotted near the base, obovate, often with the tips a little recurved. All season at irregular intervals. Armenia. R.H. 1891: 350.—A very vigorous and floriferous species. Sometimes growing 4 ft. high.

15. **praténse,** Linn. MEADOW CRANE'S-BILL. About 2½ ft. high, with an upright round st.: lvs. mostly hand-shaped, with 7 lobes, each deeply cut: peduncles mostly 2-fld., drooping after flowering; fls. large, blue;

petals entire. June, through Aug. Eu. G. 18:649. G.L. 18:208. Gn.W. 24:367. Var. **flòre-plèno**, Not so tall as parent. Very numerous deep blue fls. in clusters. June and July, and often again in fall. J.H. III. 48:305. Var. **álbum**, a white-fld. form is known.

16. **maculàtum**, Linn. WILD or SPOTTED CRANE'S-BILL. Fig. 1630. The common American species, about 1½ ft. high: st. angular: basal lvs. long-petioled, deeply 3–5-parted; st.-lvs. opposite, shorter-petioled: peduncles 1–5, infl. often unbellate; fls. 1–1½ in. broad, rose-purple; petals woolly at base. June, July. N. Amer. B.B. 2:341. S. 332.—Showy native species; should be more in cult. Grows best in somewhat wet places. Var. **plènum**, a double-fld. variety of deeper color. Var. **álbum**, a pale-fld. or pure white form is known.

17. **incìsum**, Nutt. (*G. eriánthum*, Lind.). About 1 ft. high, leafy branched, the st. thickened below, solitary: lvs. finely cut, long hairy, the hairs fine and silky: pedicels conspicuously glandular-pubescent; sepals oblong-lanceolate, mucronate; petals with stiff white hairs, inner surface purple, about 1 in. wide. Ore.—A hardy species well worth growing. Not perfectly hardy near Boston.

18. **eriostèmon**, Fisch. (*G. platyánthum*, Duthie). St. erect, slender, grooved, from an almost woody base: lvs. kidney-shaped, 5-lobed, sometimes palmately so, the lobes ovate, toothed, the teeth slightly mucronate: fls. corymbose, the sepals ovate, obtuse, very hairy; petals violet-purple, broadly obovate, entire. Native of Siberia and temp. China.—A showy and useful garden plant.

19. **sibíricum**, Linn. SIBERIAN CRANE'S-BILL. A slender, somewhat forked plant, brown-villous, 1–2 ft. high: lvs. deeply 3–5-parted: peduncles slender, usually 1-fld.; fls. very small, dingy white, the obovate petals scarcely exceeding the oblong-lanceolate 3-nerved sepals. June through Aug. Siberia, and naturalized near New York. B.B. 2:341. Jacq. Hort. Widd. pl. 19. —Another form under same name, with brick-red fls., appears to be in cult.

20. **grandiflòrum**, Edgew. A thick-stemmed perennial about 10–16 in. tall, usually somewhat glandular, branched: lvs. long-petioled, the blade 5-parted and rotund in outline, the lobes irregularly toothed: fls. bunched at the apex of the branches, showy; petals spreading, pale lilac, the veins dark purple, about as long as the sepals. N. Asia. F.S.R. 1:54. Gn. 64, p. 184.—Suitable mostly for rockeries.

21. **nepalénse**, Sweet. St. spreading or ascending, thin, not more than 18 in. long: lvs. ovate-rhomboid, deeply 5-lobed, hairy, the lobes dentate, the teeth almost spinose: fls. numerous, on hairy pedicels; sepals lanceolate, acuminate, often mucronate; petals usually about equaling the sepals, rose-purple, broadly obovate, not emarginate at apex. Mountains of Asia. June–Aug. S. 12.—Useful only in the rockery.

22. **Éndressii**, J. Gay. About 18 in. high, the st. covered with pale brown hairs: lvs. opposite, palmate, 5-lobed, upper ones 3-lobed, serrated, densely hairy, with spreading hairs: peduncles axillary, 2-fld.; petals entire, fringed at base, light rose, darker veined, 2–3 times the length of the 3-nerved, oblong-ovate sepals. Summer. Pyrenees.—Among the best for the border, and useful for cutting.

23. **Wallichiànum**, D. Don. Of prostrate trailing habit: st. and lvs. covered with silky hairs, the st. deeply grooved: lvs. light green, 3–5-parted, with deeply toothed lobes: fls. large, purple, borne sparingly all summer; sepals 3-nerved, the lateral nerves stiff-hairy; petals about twice as long as the sepals, smooth, emarginate. Himalayas. B.M. 2377. S. 90.—For the rockery and must not be grown in the open exposed parts of it. The hot dry winds of midsummer in E. U. S. are not favorable.

24. **collìnum**, Steph. (*G. Lóndesii*, Fisch.). St. angular and usually decumbent, grooved and hairy: lvs. palmately 5-parted, deeply divided and cut: sepals lanceolate-ovate, 3-nerved, densely hairy; petals entire, purple, with a tinge of violet. June, July. E. Eu.—One of the showiest in its season. Should be cut back before seeding, to induce second bloom.

25. **Grevilleànum**, Wall. St. creeping, rarely a little erect: lvs. long-petioled, the blades usually 5-lobed, kidney-shaped, hairy, the lobes deeply serrate, but not usually divided: flowering stalk thick, more or less glandular, the fls. large and showy, frequently 2 in. across; sepals oblong-ovate; petals obovate, sometimes hairy at their bases, pale rose or in some forms with large purple spots, at least as to the wild plant, 1–2 times the length of the sepals. Himalayas.—Useful for the rockery.

The following are unknown as to botanical affinities or are insufficiently known in Amer.

G. Balkànum, Hort. A hardy plant, with fragrant foliage: fls. on radical sts., 1 in. across, dark magenta. June.—*G. Heldreichii*, Hort. Orange-colored fls.=(?).—*G. Lòwii*, Hort. 2–2½ ft.: fls. bright rose with violet center. Name unknown in botanical literature.—*G. prostràtum*, Hort. Fls. purple. Advertised as "good rockery subject."=(?).—*G. sylvàticum*, Linn. About 2 ft. high, with a soft-haired, upright, round st.: lvs. 5–7-parted, lobes oblong, deeply toothed: fls. purple or violet. June, July. The common wood geranium of Eu. A white-fld. form *G. sylvàticum álbum*, Hort., is known. Gn. 72, p. 178.—*G. tuberòsum*, Linn. Tuberous-rooted, 9–15 in. high, with st. at base naked: lvs. many-lobed, linear and serrate: pedicels 1–2-fld., fls. large, violet. May. S. Eu.

N. TAYLOR.†

GERANIUM, FEATHER: *Chenopodium Botrys.*

GERÁRDIA (after John Gerarde, 1545–1607, perhaps the most popular of the herbalists). *Scrophulariàceæ*. Hardy annual and perennial herbs, all American, and mostly of the Atlantic states, with yellow or rosy purple flowers, in late summer and autumn, the later color rarely varying to white.

Leaves mainly opposite: calyx 5-toothed or cleft; corolla bell- to funnel-shaped, broad-throated, 5-parted, the 2 posterior lobes often smaller and more united; stamens commonly more or less hairy; anthers more or less approximate in pairs: caps. globose, 2-grooved; seeds usually angled, loose-coated. The first 3 species described below belong to a section in which the roots are more or less saprophytic; by some, and probably correctly, they are considered as belonging to the genus Dasystoma. These plants are therefore rather difficult to cultivate, and are offered only by collectors. *G. tenuifolia* is offered by one dealer, the seeds presumably gathered in European gardens.

A. *Fls. yellow.*

B. *Corolla pubescent outside: biennial or annual.*

Pediculària, Linn. St. much branched: pubescence partly glandular and viscid, especially on the pedicels and calyx, while in the next 2 species there is no glandular pubescence: lvs. 1–2 in. long, all pinnatifid: fls. in loose panicles or solitary, the calyx-lobes oblong and herbaceous, usually incised. E. N. Amer.

BB. *Corolla glabrous outside: perennial.*

C. *Height 3–6 ft.*

virgínica, Linn. (*G. quercifòlia*, Pursh). St. at first glaucous, sparingly branched: lower lvs. 3–5 in. long, 1–2-pinnatifid; upper lvs. rarely entire: calyx-lobes ovate, entire. Dry woods, E. U. S.

CC. *Height 1–2 ft.*

lævigàta, Raf. Not glaucous but glabrous, the st. simple or slightly branched: lvs. 1½–4 in. long, entire, or the lowest somewhat incised, all petioled, lanceolate or ovate-lanceolate: calyx-lobes ovate-lanceolate, equaling or shorter than the tube and caps. glabrous, about twice as long as the calyx. Oak barrens, etc. S. E. U. S.

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AA. *Fls. rosy purple rarely varying to white.*

B. *Height 1 ft.*

tenuifòlia, Vahl. Height 1 ft.; branching, paniculate: lvs. mostly narrowly linear: infl. racemose; corolla ½in. long, light purple, spotted, sometimes white. Low or dry ground, E. N. Amer.

BB. *Height 2–3 ft.*

linifòlia, Nutt. Perennial: lvs. erect, very narrowly linear, 1 line wide: calyx-teeth minute; corolla 1 in. long. Low pine-barrens, N. Amer. Not cult., but said to be a parent with *Pentstemon pulchellus* of **G. hýbrida,** Hort. Intro. by Haage & Schmidt, 1899. The poor cut in S. H. 2:485 seems nearer Pentstemon than Gerardia.

WILHELM MILLER.
N. TAYLOR.†

GERBÈRA (named in honor of Traug. Gerber, a German naturalist who traveled in Russia). *Compósitæ.* A small group of temperate and tropical Asiatic and African perennial herbs grown for their yellow or pink or orange flower-heads.

1631. Gerbera Jamesonii. (×$\frac{1}{10}$)

Stemless herbs with radical, petioled lvs. which are entire or sometimes lobed: fl.-heads solitary, many-fld., the conspicuous rays in 1 or 2 rows, those of the inner row, when present, very short and sometimes tubular and 2-lipped, as are the disk-fls.: achenes beaked.—There are 40 species, only one of which (*G. Jamesonii*) is well known in Amer. and is sometimes found outside the collections of botanic gardens and fanciers. They should be grown in the temperate house, in a rich compost of sandy loam and peat. Prop. by seeds or by cuttings of side shoots.

Jàmesonii, Hook. Fig. 1631. Hairy throughout, the mature lvs. very woolly beneath: lvs. numerous, the petiole 6–8 in. long, the blade 5–10 in., a little pinnatifid: heads solitary, the showy orange-flame-colored rays strap-shaped. Transvaal. B.M. 7087. G.C. III. 5:773. Gn. 36:340. A.G. 22:345. Gt. 54:1545. G.W. 2, p. 2. R.H. 1903:36.—Could be grown outdoors in the S. A brilliant summer-blooming composite, more or less planted in the open. Var. **transvaalénsis,** Hort. Has larger fl.-heads than type, of somewhat lighter color. Var. **illústris,** Hort. A robust variety.

G. aurantiaca, Sch. A handsome plant with fls. 2½ in. diam.: florets red, with bright yellow anthers. Natal and the Transvaal. B.M. 8079. Has been listed under name of G. Elsæ.—*G. cantabrigiénsis,* Hort. A garden hybrid between G. Jamesonii and G. viridifolia. G.M. 47:366, desc.—*G. viridifòlia,* Sch., is a little-known green-lvd. plant with showy fls. that are white on the upper side, yellow beneath. S. Afr.—Well worth growing in temperate house.

N. TAYLOR.

GESNÈRIA (Conrad Gesner, Zurich, 1516–1565, celebrated naturalist, and considered to be the originator of the idea of genus in taxonomy). *Gesneriàceæ.* Greenhouse and hothouse plants with showy tubular flowers. Sometimes written *Gesnera.*

Low perennials, sometimes shrubs, with simple, opposite lvs. and showy tubular fls. in terminal short panicles or fascicles: calyx campanulate, 5-parted; corolla long, straight or curved, more or less ventricose, the base often distinctly swollen or gibbous, the limb mostly shallow-toothed and nearly regular or bilabiate; stamens 4, didynamous (in pairs under the upper lip); style 1, long; glands on the disk in the fl.—Species upward of 40, in the American tropics. Often tuberous plants; allied to Achimenes, Gloxinia, Isoloma and Streptocarpus. Some of the gesnerias of the trade belong to Nægelia, which differs, amongst other things, in having an annular or ringed disk rather than a disk of distinct glands. There is considerable variation of opinion as to the limits of Gesneria. In this account, the genus is held to include Pentarhaphia, Duchartrea, Codonoraphia, Conradia, Ophianthe, Synanthera. The plants of this group are probably considerably modified by crossing and breeding. The catalogue name *G. hybrida* probably covers some of these forms.

A. *Lvs. green.*

cardinàlis, Lehm. (*Dircæa cardinàlis,* Regel. *G. macrántha,* Hort.). St. 6–12 in. high, stout, and hairy: lvs. large, cordate-ovate, crenate-dentate, petioled: fls. red, tubular, hairy, slender (2–3 in. long), the upper lip projecting and the lower one almost wanting, borne in a terminal, more or less flat cluster. Nativity unknown. B.M. 8167. Gn. 42:232. A good species for the stove.—*G. Duvàlii,* Hort., is evidently only a slender form of this species.

Héndersonii, Hort. Lvs. velvety green: fls. 3 in. long, brilliant scarlet, in a large truss. Probably of garden origin.

longiflòra, Hort., is a small-lvd. species, with drooping, long-tubed nicotiana-like white fls. Gn. 33:340.—The botanical position of this plant is in doubt. It is not the *G. longiflora,* HBK., which is purple-fld., nor *G. longiflora,* DC., which is *Achimenes longiflora.* By some it has been confounded with *Isoloma longifolium,* Decne. *Pentarhaphia longiflora,* Lindl. (*Gesneria ventricosa,* Swartz), is a small somewhat branched shrub: lvs. ovate-lanceolate or oblong-lanceolate, acuminate and serrulate, pale green beneath: fls. bright scarlet, 1½ in. long, in long-peduncled cymes; corolla-tube somewhat curved, narrowed toward the base; stamens red, much exserted. W. Indies. B.M. 7339.—A good summer- and autumn-blooming stove shrub.

AA. *Lvs. richly colored, at least beneath.*

libanénsis, Morr. (*Pentarháphia libanénsis,* Hanst. *Rhytidophýllum floribúndum,* Van Houtte. *Ophiánthe libanénsis,* Hanst.). Subshrub, but only a few inches high, simple or slightly branched: lvs. more or less rosulate toward top of st., 3–4 in. long, obovate-lanceolate, more or less blistered, toothed: fls. bright red, half as long as lvs., tubular, puffed or swollen in the middle, hairy, the mouth oblique and the limb of 5

small ciliated lobes; stamens equaling the tube; calyx very short, the segms. leafy. Cuba. B.M. 4380.

craniolària, Swartz (*Pentarháphia craniolària,* Decne.). Three to 4 ft. somewhat shrubby: lvs. glabrous above and hispid beneath, obovate-cuneiform, runcinate or more or less lobed: fls. greenish yellow with black dots, in long-peduncled clusters of 5 or 6, the corolla-lobes fringed. St. Domingo.

Lèopoldii, Scheidw. Compact: st. erect from the large, depressed tuber, thinly hairy: lvs. verticillate in 4's, broadly ovate-acuminate, more or less unequal at base, dentate, green above and purple beneath: fls. long-tubular, thinly hairy, the lobes nearly equal; light scarlet, in a rather loose, umbel-like cluster. Nativity not recorded. F.S. 7:704, 705. Gn. 53:542.

exoniénsis, Hort. Hybrid: lvs. velvety, with red and purple hairs: fls. bright orange-red, yellow in the throat, in close clusters: 1 ft.

1632. Geum rivale.

refúlgens, Hort. Probably a hybrid: lvs. cordate-ovate, red-hairy: fls. deep red or vermilion: 1½ ft. —One of the best.

Donkelæriàna, Lem. (*G. Dónklarii,* Hort.). St. often 2 ft. tall: lvs. large, cordate-ovate, crenate, hairy, green and purple-tinged above and purple beneath: fls. tubular-campanulate, the rounded lobes nearly equal, dull red, 2 in. long, hanging from long pedicels in a large panicle. Variable. Colombia. B.M. 5070. R.B. 21:97. F. 1853:241.

G. amábile, Hort.=Nægelia.—*G. cinnabarìna,* Lind.=Nægelia. —*G. guatemalénsis,* Hort., "a free grower and bloomer, fls. orange," was once offered.—*G. jasminiflòra,* Hort., "fls. of the purest white, freely produced, beautiful," once offered.—*G. oblònga,* Hort., fls. orange.—*G. oblongàta,* Hort., is probably the same and is very likely an Isoloma.—*G. Reginæ,* Hort. Exhibited abroad: lvs. green and velvety, the midrib and main veins white: fls. bluish purple.—*G. robùsta,* Hort., "vermilion, beautifully spotted and tigered."—*G. Seèmannii,* Hook.=Isoloma.—*G. zebrìna,* Paxt.=Nægelia.

L. H. B.

GETHÝLLIS (old Greek name, of no particular application). *Amaryllidàceæ.* Nine or 10 stemless herbs, with the look of crocus, allied to Sternbergia, from the Cape region, seldom cult. under glass; apparently not in the trade: lvs. usually appearing after the fls., linear, sometimes filiform and twisted: fls. appearing through the ground, of delicate texture and of short duration, fragrant, whitish, salverform, with a long slender tube and 6 similar acute spreading segms.; stamens 6 or more, attached in the throat; ovary 3-celled, concealed in the bulb-neck: bulbous. Prop. by offsets or seeds. *G. áfra,* Linn. Bulb 1½–2 in. diam.: lvs. 12–20, linear and twisted: fl. with whitish limb 2 in. or less long and tube 3–4 in. long; stamens 9–12: fr. yellowish, clavate, recorded as edible. B.R. 1016. *G. spiràlis,* Linn. Bulb 1–1¼ in. diam.: lvs. 4–6, linear-subulate, very much twisted, 4–6 in. long; perianth-tube 2–3 in. long, limb 1–1½ in. long, whitish and tinted red on the outside; stamens 6: fr. clavate, 2–3 in. long. B.M. 1088. *G. cilidris,* Linn. Bulb 1½ in. diam.: lvs. 20 or more, linear, twisted, prominently ciliate: perianth-tube 2–3 in. long, the whitish limb ½in. long: fr. yellow, clavate, 2–3 in. long.

L. H. B.

GÈUM (probably originally from Greek, *geuo,* to have a taste; referring to the roots). *Rosàceæ.* Hardy border and rock plants, some of which are valued for their bright red flowers, some for their pure yellow flowers, others for their long plumy fruits.

Herbs, with a perennial rhizome, sometimes stoloniferous: root-lvs. crowded, odd-pinnate, the alternate lobes often smaller, terminal ones largest; st.-lvs. few, mostly of 3 lfts. or bract-like: fls. 1–2 in. across, solitary or corymbose or cymose; calyx persistent, its tube nearly hemispheric, usually 5-lobed; petals 5, nearly or quite round, longer than the calyx: fr. bunched on a short receptacle, frequently plumed.—More than 50 species, mostly in temperate and frigid regions.

The plumy kinds are all contained in the subgenus Sieversia. *G. chiloense* is the best species, and in the gardens is commonly seen in double forms. A gardener writes that "inferior forms show scarcely any duplicity." Geums are of easy culture, and are propagated by division or seed. It is said that they hybridize freely if grown together. The dwarf kinds are suited only to the rockery. Correvon, of Geneva, Switzerland, writes that *G. reptans* is one of the best of the rockery kinds, and needs full sunlight. For *G. triflorum* he advises half exposure to sun and a light, moist soil. *G. rivale* grows naturally in marshy places.

A. *Plumy geums: style in fr. long and plumose*

B. *Fls. yellow.*

C. *Plants spreading by runners.*

réptans, Linn. Root-lvs. interruptedly pinnatifid; upper lvs. 3-lobed, deeply crenate-serrate: fls. erect; petals obcordate, not much longer than the sepals. Eu. Gn. 45:284.—The purple styles are pretty.

CC. *Plants not spreading by runners.*

D. *Root-lvs. pinnatifid.*

montànum, Linn. An erect and single-fld. perennial with lower lvs. lyrate pinnatifid; terminal lft. broadly ovate-rounded: calyx-lobes entire, while those of *G. reptans* are often 3-cut at apex; petals 1–2 times the length of the sepals. S. Eu. G.C. II. 13:425. Gn. 45, p. 285.—Under the name of *G. Heldreichii* and *G. Heldreichii superbum* are advertised what appear to be forms of this with orange-colored fls. which often produce more than 1 fl. The name Heldreichii is of no botanical significance. G.M. 46:371.

DD. *Root-lvs. kidney-shaped.*

radiàtum, Michx. (*Sievérsia Péckii,* Rydb.) Very hirsute: root-lvs. 2–5 in. broad: st. 1–8-fld.: bractlets minute. Mountains of N. C. and Tenn.

BB. *Fls. bright red, unmixed with yellow.*

C. *Lateral lobes of lvs. minute.*

coccíneum, Sibth. & Smith, not Hort. "St.-lvs. 3-lobed; root-lvs. lyrate, the terminal lobe largest, cordate-reniform: fls. erect. Mt. Olympus in Bithynia." The above is an exact translation of the entire description given by Sibthorp and Smith, Flora Græca, t. 485.—The chances are that all the plants in the trade under this name are really *G. chiloense.* The true *G. coccineum* is known in the botanic gardens.

CC. *Lateral lobes of lvs. 1 in. long.*

chiloénse, Balb. (*G. coccíneum,* Hort., not Balb.). "St.-lvs. 3-parted, laciniate; root-lvs. interruptedly lyrate, pilose: terminal lobe rotund, somewhat 3-lobed, crenate: fls. panicled: carpels villous." The above is a literal translation of B. R. 1348, where the terminal lobe is shown to be 2½ in. each way. Chile. B.R.

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1088, and under 1099. L.B.C. 16:1527. Gn. 14:562; 45, p. 284. R.H. 1890, p. 305; 1881, p. 309. G. 4:487. All erroneously as *G. coccineum*.

Var. **miniàtum**, Hort. (*G. miniàtum*, Robt. Parker), has fls. about two shades lighter in color. A robust form growing 2–3 ft. high, easily prop., and fls. from April to end of July. Gn. 38:298, where it is supposed to be a hybrid of *G. chiloense* var. *grandiflorum* × *G. aureum*, which is a robust many-fld. form of *G. montanum* or else of *G. chiloense* × *G. urbanum*.

Var. **grandiflòrum**, Hort., is an improved form. "The double-fld. form of this seems to be a more general favorite, the blooms lasting longer, though I think they lack the elegance of those of the simple form. They begin to expand soon after May and are produced until Oct."—D. K., in Gn. 38, p. 299. Var. **plènum**, Hort., a semi-double form, is known. It has bright scarlet fls. and is a good border plant. G. 10:495.

BBB. *Fls. chiefly dull red, mixed with yellow.*

triflòrum, Pursh (*Sievérsia ciliàta*, Pursh). Low, softly hairy: lfts. very numerous and crowded, deeply cut: fls. 3 or more on long peduncles; calyx purple, as long as the petals. Coulter says the petals are erect. Arctic Amer. L.B.C. 17:1609. Fruit showy and interesting all summer.

AA. *Not long and plumy in fr.*

B. *Style jointed and bent in the middle.*

C. *Fls. purplish orange.*

rivàle, Linn. Fig. 1632. St. erect and nearly simple: root-lvs. lyrate; st.-lvs. few, with 3 lobes or lfts.: calyx brownish purple; petals purplish orange, obovate and emarginate, narrowed into a claw. North temperate regions. Var. **álbum**, is also sold.

CC. *Fls. golden yellow.*

macrophýllum, Willd. St. erect and hairy: lower lvs. pinnatifid, 3–7-lobed, often with small lfts. irregularly placed on the rachis: fls. several, short-peduncled. E. N. Amer. B.B. 2:221.

BB. *Style not jointed, straight.*

Rôssii, Seringe. Slightly pubescent above: scape 1–3-fld.; styles glabrous. Colo., arctic regions.—Fls. large, bright yellow.

G. atrococcíneum, Hort., may be a typographical error for G. atrosanguineum.—*G. atrosanguíneum*, Hort., is presumably a form of G. chiloense, with darker fls. than the type, and sold mostly if not entirely, in its double condition.—*G. bulgáricum*, Hort.=(?). *G. Évenii*, Hort. has light orange fls. and is said to be a good border plant.—*G. japónicum*, Thunb., is sold, but little known. St. flexuose, hirsute: lvs. 3–5-lobed, hirsute: fls. erect, yellow; petals as long as the calyx: fr. hirsute, awned, recurved. Japan.

WILHELM MILLER.
N. TAYLOR.†

GEVUÌNA (from the Chilean name). Also written *Guevina*. *Proteàceæ*. One species, **G. Avellàna**, Molina (Syn., *Quádria heterophýlla*, Ruiz & Pav.), sparingly planted in Calif. CHILEAN NUT. CHILE HAZEL. An evergreen tree, with large, alternate odd-pinnate, dark green, glossy lvs. and white, hermaphrodite fls. in long, axillary racemes: sepals 4, deciduous; stamens 4; ovary nearly sessile, 1-celled and 2-ovuled, the style filiform: fr. a somewhat fleshy drupe, about the size of a cherry, coral-red when ripe, the seed having a pleasant-flavored kernel, resembling the hazel in taste and largely used by the Chileans. G.C. III. 40:174. Prop. by seeds or by green cuttings under glass. No trees of bearing age recorded in U. S., although a tree approximately 50 years old is recorded as bearing in Devonshire, England.

W. A. TAYLOR.

GHERKIN: A small cucumber. The Burr or West Indian gherkin is *Cucumis Anguria*.

GÍFOLA (anagram of *Filago*). *Compósitæ*. About 10 species of small woolly composites, of no horticultural significance, in warm and temperate countries. *G. germánica*, Dum. (*Filago germánica*, Linn.), the COTTON-ROSE, is a cottony annual plant somewhat like leontopodium, which latter is now and then collected by tourists and dyed like immortelles. It was called *Herba impia* by the old herbalists, because a new generation of clustered heads rises out of the parent cluster as if undutifully exalting itself. It is native in Eu., and has become naturalized in E. N. Amer. in dry fields. St. erect, 6–18 in.: lvs. lanceolate, upright, crowded: heads small, rayless.

GÍLIA (Philipp Salvador Gil, Spanish botanist of the latter half of the eighteenth century, collaborator with Xaurez). *Polemoniàceæ*. Annual, biennial or perennial herbs, mostly of western North America.

Flowers small, of many colors, the corolla funnelform to bell-shape or sometimes salverform, 5-lobed; stamens 5, inserted near the base of the corolla-tube, the filaments usually naked; ovary 3-loculed, with axile placentæ, the stigmas 3 (or sometimes 2).—Nearly

1633. Gilia grandiflora. (×¾)

100 species, as the genus is now understood by most botanists. Gilia is a very polymorphic genus, into which Gray now (Syn. Fl. 2, pt. 1, suppl.) throws Collomia, Linanthus, Leptosiphon, Leptodactylon, Navarretia, Hugelia, Ipomopsis, Fenzlia. In this conception, Gilia is defined as follows: "Fls. naked, not involucellate; calyx partly herbaceous, scarious below the sinuses; lobes narrow and acute; corolla salverform or funnelform to campanulate or almost rotate; filaments not bearded at base: seeds wingless: herbs, or a few suffruticose." In cult. only *G. californica* is woody. It is not certainly hardy in the E.

Several of the gilias are popular garden annuals or biennials (a few perennial). They are of the easiest culture, being vigorous, hardy and floriferous. They are mostly dwarfish, and are excellent for low masses, edgings or rockeries. Seeds may be sown where the plants are to grow. Any good soil will suit them.

INDEX.

achilleæfolia, 8.
aggregata, 12.
alba, 6, 8, 10, 14.
androsacea, 15.
aureus, 16.
californica, 18.
capitata, 6.
carmineus, 16.
coccinea, 2.
compacta, 10.
congesta, 4.
coronopifolia, 11.
debilis, 5.
densiflora, 14.
dianthoides, 17.
grandiflora, 1.
hybridus, 16.
laciniata, 7.
liniflora, 13.
linifolia, 13.
major, 6, 8.
micrantha, 16.
minima, 3.
multicaulis, 9.
nana, 10.
nivalis, 10.
rosea, 8, 10, 16.
speciosa, 17.
splendens, 10.
tricolor, 10.

A. *Plants not shrubby.* (Nos. 1–17.)

B. *Lvs. normally alternate, entire or pinnately cut or divided (lower lvs. sometimes opposite).*

C. *Fls. in dense heads, which are subtended by leafy involucres.*

D. *Foliage entire or at least not much parted.*

1. **grandiflòra,** Gray (*Collòmia grandiflòra,* Douglas). Fig. 1633. Erect, with minutely pubescent reddish sts.

1634. Flower of Gilia capitata. (×2)

1635. Gilia achilleæfolia. (×¼)

1–2 ft. high: lvs. linear-lanceolate or oblong, narrowed below but scarcely petioled, entire, acute: fls. many, in dense terminal heads, buff or salmon-color, redder inside, 1 in. long. Plains, west of Rocky Mts. B.M. 2894. B.R. 1174.—This and the next are interesting annuals. Useful as bee plants.

2. **coccínea,** Gray (*Collòmia coccínea,* Lehm.). More slender: sts. not red: lvs. narrower (mostly linear), somewhat cut at the ends: fls. smaller, slender-tubed, yellow or buff outside and brick-red inside. Chile. B.R. 1622.

DD. *Foliage pinnately parted or compound.*

3. **mínima,** Gray (*Navarrètia mínima,* Nutt.). Dwarf and tufted (3 in. or less high) often forming broad tufts, nearly glabrous: lvs. needle-like, pinnately parted: fls. white, the corolla scarcely exceeding the white-hairy calyx. In arid districts. Dak. to Ore. and Colo.

4. **congésta,** Hook. A foot or less high, erect or spreading, tufted: lvs. mostly 3–7-divided into linear divisions: fls. corymbose or in close head-like cymes; corolla white, the oval lobes nearly as long as the tube; calyx-teeth long-pointed, nearly equaling the corolla. A small-fld. species growing from Rocky Mts. to the Pacific.

CC. *Fls. not in close heads, but more or less scattered, or if capitate, the heads not leafy-subtended.*

D. *Plant perennial: seed only 1 in a locule: fls. small.*

5. **débilis,** Wats. Two in. or less high: lvs. oblong, entire or 2–3-lobed, petioled: fls. solitary and nearly sessile, the purple corolla ⅔in. long, the tube exceeding the calyx. S. Utah.—Offered by collectors, but little known in cult.

DD. *Plant annual: seeds more than 1 to the locule: corolla distinctly tubular, but relatively small.*

E. *Infl. capitate.*

6. **capitàta,** Douglas. Fig. 1634. Plant 18 in. to 2½ ft. tall, the sts. long and nearly straight between joints: fls. about ½in. long, in dense, nearly globular heads, which terminate long, naked sts.; corolla-lobes lance-linear, acute: lvs. cut into very unequal linear lobes. Calif. and Ore. B.M. 2698. B.R. 1170. G.W. 15, p. 214.—An old favorite. There is a white form (var. **álba**). There is also a var. **màjor.**

7. **laciniàta,** Ruiz & Pav. Much like the last in botanical characters, and possibly a form of it: lower and much more slender, the lf-divisions mostly very narrow (usually almost thread-like), the heads smaller or the fls. sometimes even scattered. Chile.—The fine foliage and compact habit make this species an excellent garden plant.

EE. *Infl. mixed, capitate on the main branches, scattered on the others.*

8. **achilleæfolia,** Benth. Fig. 1635. Stout (2–3 ft.) and very branchy and bushy, the early main branches terminating in large, dense heads, but the later, finer growth bearing scattered fls.: lvs. small, with short, linear lobes or teeth: fls. large, violet or purple-blue, the corolla-lobes oblong or obovate: caps. large. W. Calif. B.M. 5939 (showing only capitate infl.).—An old garden plant. Fls. vary to white and rose, and there is a large-fld. form. Various horticultural names are in use for these forms, such as *álba, ròsea, màjor,* etc.

9. **multicaùlis,** Benth. Not unlike the preceding, from which it differs only in its smaller fls. and more distinctive habit. Calif. B.M. 3440 and B.R. 1682, both as *G. achilleæfolia* from which this may not really differ.

EEE. *Infl. scattered or loosely cymulose.*

10. **tricolor,** Benth. Fig. 1636. A very diffuse, twiggy grower, 2–2½ ft. high, sparsely pubescent: lvs. few on the full-grown plant, small, with many short, very narrow or needle-shaped divisions: fls. comparatively large (¾in. long or nearly so), nearly or quite bell-shaped, the corolla 2–3 times the length of the calyx; color of the roundish lobes violet and passing to whitish at the base, of the throat brown-purple and of the tube yellow. W. Calif. B.M. 3463. B.R. 1704.—One of the commonest of garden annuals. There is a white form (*G. nivàlis,* Hort. *G. álba,* Hort.), Gn. 72, p. 201, and a rose-colored form (*G. ròsea,* Hort.), and a red-violet form (var. *rùbro-violàcea,* Hort.) Besides these a small form has been called *G. nàna,* a large one *G. spléndens,* and a dense, stiff one *G. compácta.* None of these names appears to be in anything but trade catalogues. Thrives with the least care, and is always a profuse bloomer. It requires an open warm situation.

1636. Gilia tricolor. (×½)

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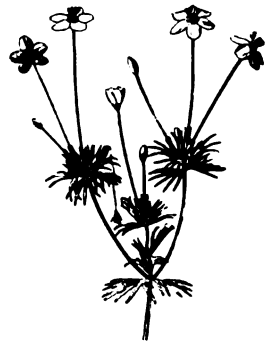
DDD. *Plant biennial: seeds few or many in each locule: fls. large and long-tubular, red (running into white forms), the corolla very much surpassing the subulate calyx-lobes. (Ipomopsis.)*

11. **coronopifòlia,** Pers. (*Ipomópsis élegans,* Poir. *I. aurantiaca* and *I. sanguínea,* Hort.). STANDING CYPRESS. St. strict and unbranched, sometimes 6 ft. high, very leafy: lvs. pinnate, the divisions needle-like and about 1 in. long: fls. many, 1½ in. long, long-

1637. Gilia liniflora. (×¾)



1638. Gilia micrantha. (×½)

trumpet-shape, borne along the sides of the summit of the st., the calyx inconspicuous amongst the short bract-lvs., the corolla scarlet or pink-red and dotted and yellowish within, varying to orange, its lobes obtuse or nearly so and flaring. In dry soil, S. C., south and west. B.R. 1691. G.C. III. 40:277. G.M. 49:598. Gn. 70, p. 165.—Common old garden plant, and worthy. Fls. scentless. Name should probably be *G. rubra,* Heller.

12. **aggregàta,** Spreng. (*Ipomópsis élegans,* Lindl.). Differs in mostly shorter stature, pubescent st., and more slender habit, with redder (sometimes white) fragrant fls., with acute and reflexing corolla-lobes. Neb., south and west. B.R. 1281.—The fls. are fiery scarlet or sometimes nearly white. A very showy biennial.

BB. *Lvs. opposite, entire, or, if alternate (as in No. 13) palmately parted.*

C. *Foliage very fine, the lvs. cut into thread-like or linear divisions.*

D. *Corolla rotate-bell-shape, with a short, flaring tube.*

13. **linifòra,** Benth. (*G. linifòlia,* Hort.). Fig. 1637. Ten to 20 in. high, diffuse and branchy: lower lvs. mostly opposite, but the upper alternate, all palmately divided to the base in needle-like or spurrey-like divisions: fls. rather large for the size of the plant, the corolla white or blush, nearly rotate, the thin lobes obtuse. Calif. B. M. 5895.—A useful tufty garden annual. The name *liniflora* is meant to designate the resemblance of the fls. to those of *Linum tenuifolium;* but some catalogue-maker, evidently thinking that the name meant *linear-flowered,* and was therefore inappropriate or an error, has changed the name to *G. linifolia,* under which name it is known in the trade.

1639. Gilia dianthoides, the Fenzlia of gardens.

DD. *Corolla salverform, with a filiform and elongated tube. (Leptosiphon.)*

14. **densiflòra,** Benth. (*Leptosìphon densiflòrus,* Benth.). Erect or even strict, 1–2 ft., hairy: lvs. with many filiform somewhat rigid divisions: fls. in rather close heads, lilac or white, ½–¾ in. long; tube of the corolla scarcely longer than the lvs.; lobes of the corolla spreading, obtuse, often dentate, nearly or quite as long as the tube. Calif. B.M. 3578. B.R. 1725.—Common garden annual. The white-fld. form is known as var. **álba,** Hort.

15. **androsàcea,** Steud. (*Leptosìphon androsàceus,* Benth.). Much like the last, but the tube very slender and much exserted beyond the calyx and lvs.: fls. 1 in. long, pink, lilac or white, in rather close heads, the corolla-lobes ovate-acute and entire, much shorter than the tube, 12–18 in. Calif. B.M. 3491. B.R. 1710.

16. **micrántha,** Steud. Fig. 1638. Tufted, 8 in. or less high, the sts. most leafy near the top: lvs. short, fascicled: fls. with an exceedingly slender thread-like tube which is 1–1½ in. long, and projecting prominently above the upper fascicles of lvs., the corolla-lobes spreading and obtuse; color range very wide,—from purple to lilac, red, yellow and white. Calif.—A popular bedding plant. Forms of it are known as *Leptosiphon aureus, L. carmineus, L. hybridus,* and *L. roseus.*

CC. *Foliage of entire (but narrow) lvs.*

17. **dianthoìdes,** Endl. (*Fénzlia dianthiflòra,* Benth.). Fig. 1639. Tufted, 6 in. or less high: lvs. narrowly linear, opposite: fls. 1–1½ in. long, lilac or purple, with yellowish throat, the flat-spreading lobes denticulate or nearly fringed. S. Calif. B.M. 4876. R.H. 1865:11.—A choice little annual, excellent for edgings and rock-work, bearing a profusion of pink-like fls. The fls. sometimes vary to white (*Fénzlia álba,* Hort.). A large-fld. form is called *C. speciòsa.*

AA. *Plants shrubby.*

18. **califórnica,** Benth. A low, procumbent and much-branched shrub: lvs. alternate, deeply digitately parted into 5–7 stiff and hairy segms: fls. showy, very free; sepals subulate, mucronate; petals cuneate, sometimes toothed, rose-colored. Calif. B.M. 4872.—A fine showy species, perhaps not hardy in the E.

G. abrotanifòlia, Nutt., occurs in mountains back of Santa Barbara, and has been listed in collections of native plants for sale: 1–2 ft., simple or somewhat branched: lvs. ample, all tripinnately dissected, the ultimate segms. very narrow and acute and curved backward: fl. without markings (blue?), large, the lobes spreading, obovate and obtuse; stamens scarcely protruding.—*G. Chamissònis,* Greene, is a segregate from G. achillæfolia: annual, but sometimes persisting over winter, 1 ft.: lvs. mostly twice pinnately dissected into linear segms.: branches few and peduncle-like, bearing large and dense heads of blue fls. Calif.

L. H. B.
N. TAYLOR.†

GILIBÉRTIA (J. E. Gilibert, 1741–1814, France, physician and botanist). *Araliàceæ.* A genus of very few Trop. American shrubs (if Dendropanax is separated) that are not known in cult. The name is one frequently but incorrectly used by gardeners for Trevesia, and *G. palmata* is described under that genus. *G. paniculata* and one or two others are referred to Polyscias. Gilibertia differs from Trevesia in having parts of the fl. in 6–8's instead of 8–12's, and in its simple entire lvs. From Dendropanax it differs mostly in its 6–8-merous rather than 5-merous fls. N. TAYLOR.

GILLÈNIA (dedicated to an obscure German botanist or physician of the seventeenth century, A. Gille or Gillenius). Syn. *Porterànthus. Rosàceæ.* Excellent graceful plants for the mixed border, rockeries, or other hardy gardens.

Erect, perennial herbs, 2–4 ft. high, with nearly sessile, 3-foliate, or 3-parted, stipulate lvs.: fls. white or pinkish, loosely panicled, perfect, perigynous; cup-shaped receptacle narrow, somewhat contracted at the mouth, 5-toothed; petals strap-shaped, unequal, 4–8 lines long; stamens 10–20, very short; pistils 5, superior, lightly coherent, later distinct, pubescent: fr. consisting of 5 2–4-seeded follicles.—Two species. They are hardy and of easy cult. in any good soil. Prop. by seeds or division.

trifoliàta, Moench. BOWMAN'S ROOT. Lfts. serrate; stipules small, awl-shaped, mainly entire. Cent. and S. U. S. B.M. 489 (as Spiræa). Mn. 8:129. J.H. III. 43:188.

stipulàta, Trel. (*G. stipulàcea,* Nutt.). AMERICAN IPECAC. Lfts. incised; stipules large, broad, and leaf-like, doubly incised. Cent. and S. U. S.

K. M. WIEGAND.

1640. Ginkgo biloba.

GILLYFLOWER. Down to Shakespeare's time usually referred to what we now call the carnation, *Dianthus Caryophyllus,* also known as clove pink. Since Shakespeare's time gilliflower has usually meant either wall-flowers or stocks, as explained under Cheiranthus and Matthiola.

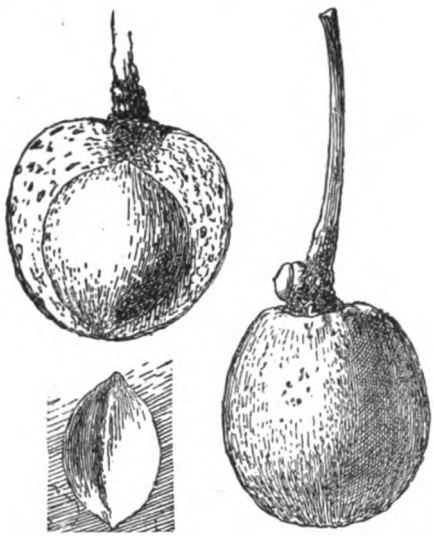
GINGER: *Zingiber officinale.* **Wild Ginger:** *Asarum canadense.*

GINKGO (Chinese name). Syn., *Salisbùria. Ginkgoàceæ,* one of the segregates from the *Coniferæ.* One species in northern China and Japan, the sole remainder of a more numerous tribe in geologic time; now widespread as a street and park tree and also prized for the edible seeds.

Tall tree, with wedge-shaped deciduous lvs.: fls. small and mostly dicœcious; pistillate fl. solitary, the single naked ovule ripening into a drupe; staminate fls. in slender, loose catkins: fr. a drupe about 1 in. diam., containing a very large lenticular seed or kernel.

1641 Ginkgo leaves and fruit.

bíloba, Linn. (*Salisbùria adiantifòlia,* Smith). GINKGO. MAIDENHAIR TREE. KEW TREE. Figs. 1640–1642. A straight, sparsely branched, usually slender tree, attaining a height of 60–80 ft.: lvs. 3–5, 1-clustered, fan-shaped, divided at summit, with thickened margin, striated on both sides with numerous parallel veins: fls. dicœcious; male catkins slender, stalked; females on long footstalks, in pairs, of which one usually aborts: fr. a drupe, consisting of an acrid, foul-smelling pulp surrounding a smooth, angular oval, cream-colored, thin-shelled, sweet-kerneled nut. F.S. 10, p. 119. G.C. III. 5:265, 269. G.F. 1:175 (adapted in Fig. 1640). A.G. 12:268. Gng. 6:194. G.M. 52:1011.



1642. Ginkgo fruit. (Natural size)

Gn. 66, p. 345. Gn.M. 2:11. G.W. 3, p. 542; 10, p. 285; 15, pp. 589–593. J.H. III. 64:148.—The ginkgo was intro. to Amer. early in the last century; it is generally successful on good soil in the eastern states as far north as E. Mass. and Cent. Mich., and along the St. Lawrence River in parts of Canada. It is of special value for solitary planting to secure picturesque effects. It is considerably planted in Washington, D. C., where it is growing in esteem as a street tree because of its upright habit and freedom from insect injury. Easily prop. from seed, stratified in autumn; varieties by budding and grafting. Several horticultural forms are recognized, including *laciniata, pendula* and *variegata.* The foul odor of the ripe frs., which continue to mature and drop during a period of some weeks, constitutes the chief objection to the species as a street tree, or near dwellings, and suggests the advisability of prop. from staminate trees by grafting or budding, for planting in such locations. The kernels, which have a sweetish, slightly resinous flavor, are highly esteemed for food in China and Japan, and are gathered from fruiting trees in Washington for such use by Chinese laundrymen.

The word Ginkgo seems to be pronounced with a hard initial G in the orient, but in English a soft G should be used. The name is often spelled Gingko, but the other spelling is that used by Linnæus.

W. A. TAYLOR.

GINSENG (*Pànax quinquefòlium,* Linn. *P. Ginseng,* Meyer. *Aràlia quinquefòlia,* Decne. & Planch.) is to the Chinese more than quinine or any other drug is to Americans. As its name Panax implies, it is a panacea, being employed for all the ills that flesh is heir to. Though credited with stimulating, aromatic, alterative, carminative and tonic properties, the root is with us

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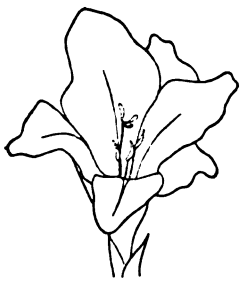
seldom used except as a demulcent. The reverence in which it is held, and the high price that it commands in China, led to extensive search for a substitute, which resulted in the discovery in 1716 of American ginseng, *Panax quinquefolium*, near Montreal, Canada. This root was favorably received by the Chinese, and soon became an important article of export. During the past fifty years the price of American ginseng has advanced nearly 700 per cent, but owing to the energetic hunt for the root, to the destruction of forests and to the gathering of plants at improper times, the wild supply has greatly decreased. With the advancing prices and the diminishing supply came experiments in ginseng cultivation, most of which failed through ignorance of the plant's peculiarities. The seed ripens in September. If dry it will not germinate until the second year, but if fresh and properly kept nearly all the seeds will germinate the first season. The soil must be a light, friable loam, free from stones, rich in humus and well drained; the plants must be well supplied with shade and moisture. Cultivated ginseng already commands a considerably higher price than the wild root, and, though no returns can be expected from a plantation under three or four years, the industry is profitable to the men that have given it careful attention.



1643. Parts of a gladiolus flower. Showing the three stigmas, three stamens, six segments of the perianth, and the tips of the spathe-valves.

Ginseng beds can be located in orchards, gardens, or woods, where the roots may remain without danger of deterioration for several years after they first attain marketable size. The roots are so valuable that they are likely to be stolen, and beds should, therefore, be placed where they can be guarded.

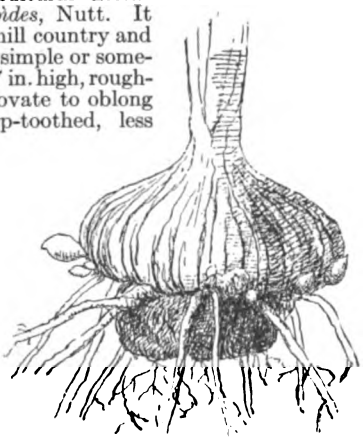
For further information on ginseng, send to Division of Publications, Department of Agriculture, Washington, D. C., for Bulletin No. 16 of the Division of Botany, revised by M. G. Kains in 1898, or consult Kains' Ginseng, its culture, etc., Orange Judd Company 1899; second edition, 1902. For diseases, consult Cornell bulletins.

M. G. KAINS.

GITHÀGO: *Lychnis.*

GITHÓPSIS (*like Githago*, from the calyx). *Campanulàceæ*. One blue-fld. annual in Calif., sometimes recorded in horticultural literature, *G. specularioìdes*, Nutt. It grows in the open hill country and the mountains: st. simple or somewhat branched, 4–7 in. high, rough-pubescent: lvs. obovate to oblong or narrower, sharp-toothed, less than ½in. long: corolla tubular-bell-shaped, the lobes shorter than the tube; calyx 10-ribbed, adnate to the ovary: fr. a coriaceous caps., bearing the rigid calyx-lobes, dehiscing at apex. Var. *diffùsa*, Jepson, is nearly glabrous, but sinuses of calyx somewhat hispid.

L. H. B.



1644. Gladiolus corm growing above the old one; and the cormels from the bottom.

GLADÌOLUS (diminutive of Latin *gladius* a sword, from the shape of the leaves. Popular summer-flowering and autumn-flowering bulbs, and now somewhat grown under glass.

Corm-bearing herbs with fls. in simple or branched spikes; lvs. radical and cauline: fl. more or less tubular, the tube usually funnel-shaped (enlarging upward); segms. 6, more or less unequal, strongly narrowed or even clawed at the base, the upper ones often hooded or roofed over the opening or mouth of the fl.; stamens 3, inserted on the tube; stigmas 3, on a long style; ovary 3-loculed, becoming an oblong 3-valved caps., with flattened and winged or sometimes globose seeds: each fl. is borne in a sessile spathe (like a calyx) with linear or lanceolate valves or lf.-like parts: the lvs. are mostly equitant on the st., all firm and prominently several-ribbed, varying from linear to sword-shaped (sometimes almost terete): the old corm dies and a new one grows on top, and cormels or offsets (sometimes called "spawn") form from the underpart (Fig. 1644).—The species of Gladiolus are 160 or more, perhaps 100 being in S. Afr. (Cape), many in Trop. Afr. in both the E. and the W., and others in the Medit. and W. Asian regions. The greater part of highly improved garden forms are derived more or less directly from the S. African species. The Eurasian species are little grown, although some of them are hardy. Gladioli have been much modified by variation, hybridizing and selection.

The gladiolus is propagated readily by seeds, as explained farther on; by the use of the new corm growing above the old one, and which is separated either when cleaning in autumn or before planting in spring; by the young corms, or cormels. Increasing stock by the small corms or cormels is the most common method, and the one by which a variety is perpetuated. The small corms are stored in bags, boxes or other suitable receptacles and kept from frost. It is a help to sprouting if the cormels are not allowed to dry out during the period of rest. They should be planted like one-year seedlings, and they give blooming plants the first and second year.

Great progress has been made in recent years in the improvement of the gladiolus, until in floriferousness, form, color, substance and keeping qualities it has become one of the important summer flowers, both for amateurs and florists. It is to be expected, however, that many other forms and qualities are yet to appear, considering the great number of wild species of much beauty that have not been combined in the cultivated strains. It may be possible, also, that closely related genera can be used to some extent in hybridizing. The lines of division between Gladiolus, Antholyza, Acidanthera, and some others, are more or less arbitrary.

The early departures were of the gandavensis (Fig. 1645) and similar types, founded probably on *G.*

1645. Gladiolus gandavensis. (×⅓)

psittacinus and *G. cardinalis*. Forms of *G. tristis* early entered into the cultivated strains, as well as *G. oppositiflorus*, and later *G. purpureo-auratus* and *G. Saundersii*. The Lemoinei and nanceianus races (Fig. 1646) have afforded foundations for much subsequent breeding. Recently, *G. primulinus* has entered into the combinations. It seems to be particularly valuable as a parent; it is said to be dominant in color over even the deepest reds, subduing them to excellent shades of orange, salmon, and terra-cotta; when crossed with the lighter colors it transforms them to buff, lemon and ecru; combined with yellow the color is deepened. The hooded character is commonly inherited. W. W. Van Fleet has succeeded in crossing this species with many of the other wild forms. With *G. Quartinianus* the color is said to be toned down to terra-cotta and the season for blooming is changed from autumn to midsummer. When *G. Watsonius* is used, the progeny is tall, orange in color with scarlet veinings; the plants are earlier, more vigorous, and profuse bloomers. Hybrids from the above species, and from varieties of *G. cardinalis* produce tall graceful spikes of exquisite light tints.

1646. Gladiolus Lemoinei (on the right), and G. nanceianus. (×⅓)

The ruffled strains of gladioli have appeared in recent years, adding a pleasing variety and much merit to the flower. This type has been specially developed in the recent breeding work of A. E. Kunderd, of Goshen, Indiana (Fig. 1647). Nearly twenty years ago he began his selections for the production of a frilled or wavy flower, that should have something of the petal-edge exhibited so well in azalea. Early- and late-flowering strains have been produced. It is said that one strain has the blood of *G. Quartinianus* and is producing many good shades of red with fluted or ruffled petals and suitable for late-flowering purposes. *G. primulinus* has also given good tints in yellows, with flowers very much frilled. It now seems possible to introduce the ruffling into many of the standard types, much as has been done with the sweet pea.

The recent Burbank strains have been developed from the variety America as the seed-parent. These are said to comprise many very large-flowered forms, with brilliant coloring.

The *G. præcox* group or strain was introduced by Frederick Roemer, of Quedlinburgh, Germany, said to be the result of intercrossing the earliest-flowering plants of *G. gandavensis*, *G. Lemoinei*, *G. Childsii* and *G. nanceianus*. In color, markings, or size, the race compares favorably with the parents, and at the same time the plants bloom the first year from seed, especially when the seed is started in a moderate hotbed in March. As growth advances, they are given ventilation gradually. There is a decided improvement the second year, when two or more spikes of normal size are usually produced. Other strains of gladiolus may also give bloom the first year from seed.

Some of the earlier history of American gladiolus-breeding was written for the "Cyclopedia of American Horticulture" by H. H. Groff, of Canada, one of the prominent contributors to the improvement of the flower (extracts): Some twenty-five years ago "when the writer, under the inspiration of Luther Burbank, began his own work in hybridization, the best American-grown stock available was the Hallock collection of some 400 named varieties of gandavensis and about 100 of the earlier Lemoine hybrids, all of European origin. After trial, the writer placed them all in mixtures. About this time Luther Burbank began to offer a few named varieties, but shortly afterward sold his whole stock, the collection being now in the writer's hands. This collection, in the opinion of the writer, is the best strain of gandavensis. The varieties were largely of variegated types, with many of unique markings and peculiar form. Burbank had given particular attention to varieties calculated to withstand the hot, dry winds of California, and had originated several with specially stiff petals, quite distinct from the ordinary types. The peculiarity of the flowers blooming around the spike like the hyacinth was also his contribution. All of his varieties are now grown in mixture by the writer with the exception of a white variety, which promises to be distinct and valuable for some time to come. The work of Van Fleet, of New Jersey, was carried on more for scientific than commercial results, and reaped a deserved success. However, the writer has found that the offspring of a pure species is less stable than that of well-balanced cross-bred varieties, the former system handing down few varieties of permanent commercial value, though they are in themselves valuable as parents for the foundation of new strains. The best work of a semi-professional character, in the opinion of the writer, has been done by T. S. Moore, of Indiana, who has spared no trouble or expense in procuring choice material upon which to build, and with satisfactory results." Writing in 1914, Groff speaks of the fluted, ruffled and crimped forms being frequent in the progeny of every improved species; of the development of iris-form flowers; and of innumerable influences, under breeding, on the character of the stalk, fiber, capsule, shape and size of foliage, disposition of flowers to droop or to grow erect, on the corm and its husk and the facility of producing cormels, and other interesting departures.

The interest in the gladiolus has been much stimulated in North America by the work of the American Gladiolus Society. It was organized at Boston, May 27, 1910, for the purpose of "stimulating interest in, and promoting the culture and development of the gladiolus; to establish a standard nomenclature; to test out new varieties, and to give them such recognition as they deserve; to study the diseases of the gladiolus, and find remedies for same; to disseminate information relating to this flower; to secure uniformity in awarding prizes at flower shows, and to give one exhibition each year." The society holds exhibitions, publishes a bulletin, and in many ways aids in the popularizing of the gladiolus and in establishing standards of excellence. It has a trial-ground at the New York

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State College of Agriculture at Cornell University, where gladioli are now being carefully studied.

Following is a score-card prepared by direction of Gladiolus Society of Ohio:

	Points
1. Spike (long, 5; straight, 5; many blooms, 5; facing together, 5)	20
2. Flower (large, 5; widely opened, 5; broad, round petals, 5; substance and texture, 5; beauty of bud, 5)	25
3. Color (attractive, 10; either self-color, or strikingly marked, 5; adapted to cut-flower trade or florists' use, 5)	20
4. Foliage (dark, healthy green, 5; broad, 5; abundant, 5)	15
5. Durability (continuance of bloom on spike, 5; lasting qualities as cut-flower, 5)	10
6. General effect (in mass bed or field, 5; in vase or cut display, 5)	10
Total	100

Culture of the gladiolus. (Isaac S. Hendrickson, except when otherwise stated.)

The Gladiolus has several good points combined to make it interesting, popular, and promising, as: The low cost; ease of culture; freedom from insects; variation in color; ease of carrying over from year to year; length of blooming season; rapid increase; ease with which new varieties are produced.

Figures recently compiled from information given by the growers in the United States are as follows:

Number of acres devoted to gladioli	400 to 500.
Estimated number of bulbs produced annually	14,000,000 to 15,000,000
Estimated value of crop	$250,000

Raising new varieties.

It is the contention of some growers that certain definite results can be secured by hand-crossing of different varieties, while other growers assert that they cannot trace a single valuable result to that method. The writer's observation has led him to the opinion that some of the best and most useful sorts on the market today are the results of careful selection of seed from the varieties showing best form, growth, color, vigor, size, and other qualities. It is well for the general gardener to purchase a collection of the best-named kinds now on sale, plant them together and let the insects transfer the pollen naturally; and if the weather is favorable, one is almost sure to have a crop of seed. This seed must be carried over until the following spring, when it can be planted in shallow drills, covering about one-eighth to one-fourth inch with soil; they will make only a slight grass-like growth the first year, and must be taken up in the fall, and housed away from frost. The following spring they can be planted as one would sow garden peas, and covered about 1½ inches deep; they will make a little more growth and perhaps a small percentage will flower, but the bulbs will have to be lifted and planted once more before a good showing of flowers can be expected. The commercial grower expects to wait three or four years after planting the seed before he has salable bulbs, which of course, can be sold only as seedlings or mixtures as all forms and colors will be present. In looking for new varieties to name, the greatest care must be taken to choose only those of real merit, something that is distinct from previous selections, new in color, good in substance, excellent in form, and in all ways meritorious. When the selection is finally made from perhaps thousands of seedlings, it is labeled out and lifted separately in the fall, and jealously guarded until the next planting-time; then it is watched with eagerness to see whether it will prove constant and worth taking the trouble to "bring up," for as it requires at least ten years to secure enough bulbs to offer for sale, one can easily waste much time if the selection does not prove to be a wise one. It is often said that there are too many varieties now under name, and this is true; but as it is so very easy and so fascinating to grow seedlings, one should not discourage the amateur in securing this satisfaction.

Of course the professional or expert breeder will exercise the most careful choice of the parent stocks; and he is able to make many interesting and valuable combinations of special qualities.

Culture.

While nearly any good garden soil is adapted to the culture of the gladiolus, the plant seems partial to a sandy loam. In field culture, gladioli are usually planted in rows similar to potatoes; that is to say, the furrows are made 3 feet apart to allow tillage with horse. The bulbs are placed in the row by hand, usually about 2 to 4 inches apart each way according to size, and covered about 4 or 5 inches deep. Deep planting prevents them blowing over. Frequent tillage must be given in spring and summer.

1647. The ruffled gladiolus. (×⅛)

For garden culture, they may be planted promiscuously in the border if wanted for garden decoration; or if wanted for cut-flowers principally, the straight-row method is best, as it enables better tillage to be given and makes it much easier to cut the blooms. The gladiolus is essentially a cut-flower. If one has a goodly number of bulbs, it is an excellent plan to make successive plantings about fifteen days apart, beginning as early as the ground can be worked and continued until July. This will insure continuous bloom from July until October, or until the plants are cut down by frost. As the old bulb or corm produces its flower, it dies and a new one forms in its place, and develops until harvest time, when it is lifted and stored in a warm dry place; some time during the winter the roots and old bulb should be taken off, so that the bulb will present a clean appearance and be ready for planting.

As a cut-flower, the gladiolus will rival most other flowers in keeping qualities. The blooms can be kept fresh and beautiful for a period of five to ten days after cutting by changing the water daily and removing each day the withered blooms; it also helps if the ends of the spike are nipped off when changing the water. If the spikes are cut when the first two or three flowers have opened, the entire stalk will open out after it has been put in water. They may be sent to a distance; they will arrive in excellent condition if

a little care is taken when shipping. The spikes should be cut when the first flower opens, and put in water in the cellar or cool place for two or three hours, after which they will stand a journey of two or three days; and then when placed in water they will quickly respond and unfold their petals.

The uses of gladioli are varied; great quantities are used for decorating dining tables in the great hotels and steamboats; florists have long recognized their value in making funeral designs; at the exhibition of the American Gladiolus Society, at Rochester, it was demonstrated that they can be used for fancy table decoration, wedding bouquets, and other purposes.

Varieties.

No two persons will agree on varieties, but the following represent some of the good types at present (given here as a matter of record):

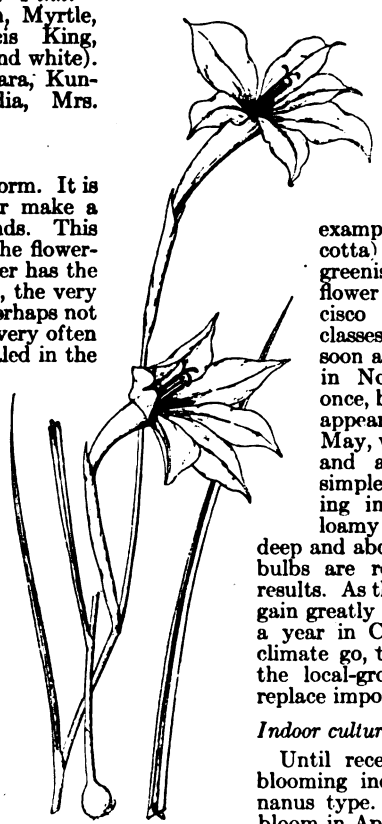
White.—Europa, Blanche, Peace, LaLuna. *Pink.*—Wild Rose, America, Mrs. Frank Pendleton, Myrtle, Taconic, Panama. *Scarlet.*—Mrs. Francis King, Princeps, Brenchleyensis, Contrast (scarlet and white). *Yellow.*—Golden King, Sulphur King, Niagara, Kunderdi Glory. *Maroon.*—Empress of India, Mrs. Millins. *Violet.*—Baron Joseph Hulot.

Variation in size of bulbs.

There is great variation in size of bulb or corm. It is a varietal characteristic. Some kinds never make a large bulb, yet they may be superior kinds. This ought to give a hint in buying mixtures at the flower-shop. Nine times out of ten, when a customer has the opportunity to pick out the bulbs personally, the very largest ones are taken, with the result that perhaps not more than one or two kinds are received, as very often the very best and choicest flowers are concealed in the small or medium-sized corms. Some of the large-bulb sorts are very inferior, and it is easy to increase the stock, while others, perhaps producing smaller bottoms, bear only a few offsets.

Commercial cultivation for stock or bulbs. (E. H. Cushman.)

For successful commercial culture it is essential that sandy soil conditions are obtainable. Such preparation of the soil as puts it in a loose, friable condition will answer. Probably the ideal soil is a sod, fall-plowed and then most thoroughly worked in the spring. Strong, fresh stable manure should be avoided. If soil is not sufficiently rich in plant-food it is best to use all strong manures on a previous season's crop of some other kind. Any complete fertilizer is beneficial when thoroughly worked through the soil, at the rate of 600 to 1,000 pounds to the acre. Planting should be begun as early in the spring as the proper working of the soil will permit. The ground being prepared, it should be furrowed 4 inches deep and from 24 to 36 inches apart, according to method of cultivation. If fine, round bulbs are to be grown, and the stock for planting exceeds 1½ inches in diameter, it will be necessary to place the bulbs right side up in the furrow by hand, either in single or double rows 2 inches apart. Bulbs of lesser size may be scattered as evenly as possible along the furrow, with an average of ten or twelve to the foot of furrow. Clean culture throughout the growing season is essential. Cutting the spike of flowers is a help to increasing the size of the bulbs. Four months is sufficient for the growth and maturity of the bulb. To harvest, loosen the soil and lift the bulbs by their tops, and lay on the ground to dry off and ripen. Should weather permit, they can be entirely ripened out-of-doors. Cut the tops off close to the bulbs, pulling off the old bulbs and roots, and place in thin layers in crates and store in a cool, dry place. If circumstances require, the tops may be trimmed off at once on lifting, and the bulbs taken under cover for cleaning and drying.



1648. Gladiolus tristis var. concolor. (×½)

Culture in California. (Sydney B. Mitchell.)

Gladioli, like all South African bulbs, do very well in California; indeed near Santa Cruz, some of the popular large-flowering varieties are grown in commercial quantities for their bulbs. These summer-flowering kinds may be planted in the fall to bloom in the following May and June, but in private gardens additional corms should be put in at intervals from April to July so that a succession of flowers may be available until October, right through the season when California gardens are barest. It should be noted that the early-flowering class of the nanus and Colvillei types are also quite hardy here and so do not require the glass protection given in the East. The favorite varieties of the nanus or dwarfs are Peach Blossom and Blushing Bride, while The Bride easily leads in the Colvillei section. A few of the less-known early species are also grown occasionally, as for example *G. tristis* (yellow and terra-cotta) and its variety *concolor* (pale greenish yellow), both of which flower in March around San Francisco Bay. The earlier-flowering classes should all be planted just as soon as available in late October or in November. Growth starts at once, but the flowers usually do not appear much before the following May, when they make a brave show and are fine for cutting. Their simple requirements are fall-planting in a well-drained, preferably loamy soil, put about 3 inches deep and about the same apart. Separate bulbs are reset each autumn for best results. As they increase quite rapidly and gain greatly in vigor after they have had a year in California, as far as soil and climate go, there is no good reason why the local-grown bulbs should not quite replace imported ones.

Indoor culture. (A. C. Hottes.)

Until recently, the gladiolus used for blooming indoors was principally of the nanus type. Planted in November, they bloom in April and May. They may first be started in 5-inch pots and later benched. They require a cool temperature, about 45° at night, if one expects the foliage to develop nicely. This is a temperature near that of the carnation optimum; they are therefore, often planted around the margins of the carnation benches. Their growth at first is slow, making little growth till the sun gets higher in the spring.

The flowers of the nanus type appear two or three weeks earlier than the standard varieties of gandavensis, Lemoinei or nanceianus. Varieties of the latter groups, however, are being developed with the desirable qualities for forcing, that of earliness and of a pleasing commercial color, and are becoming of considerable importance as a spring flower for the florist.

If the stems are not cut too short, the corms will renew themselves as well as in outdoor culture and they can be forced again or given a year's growth in the field.

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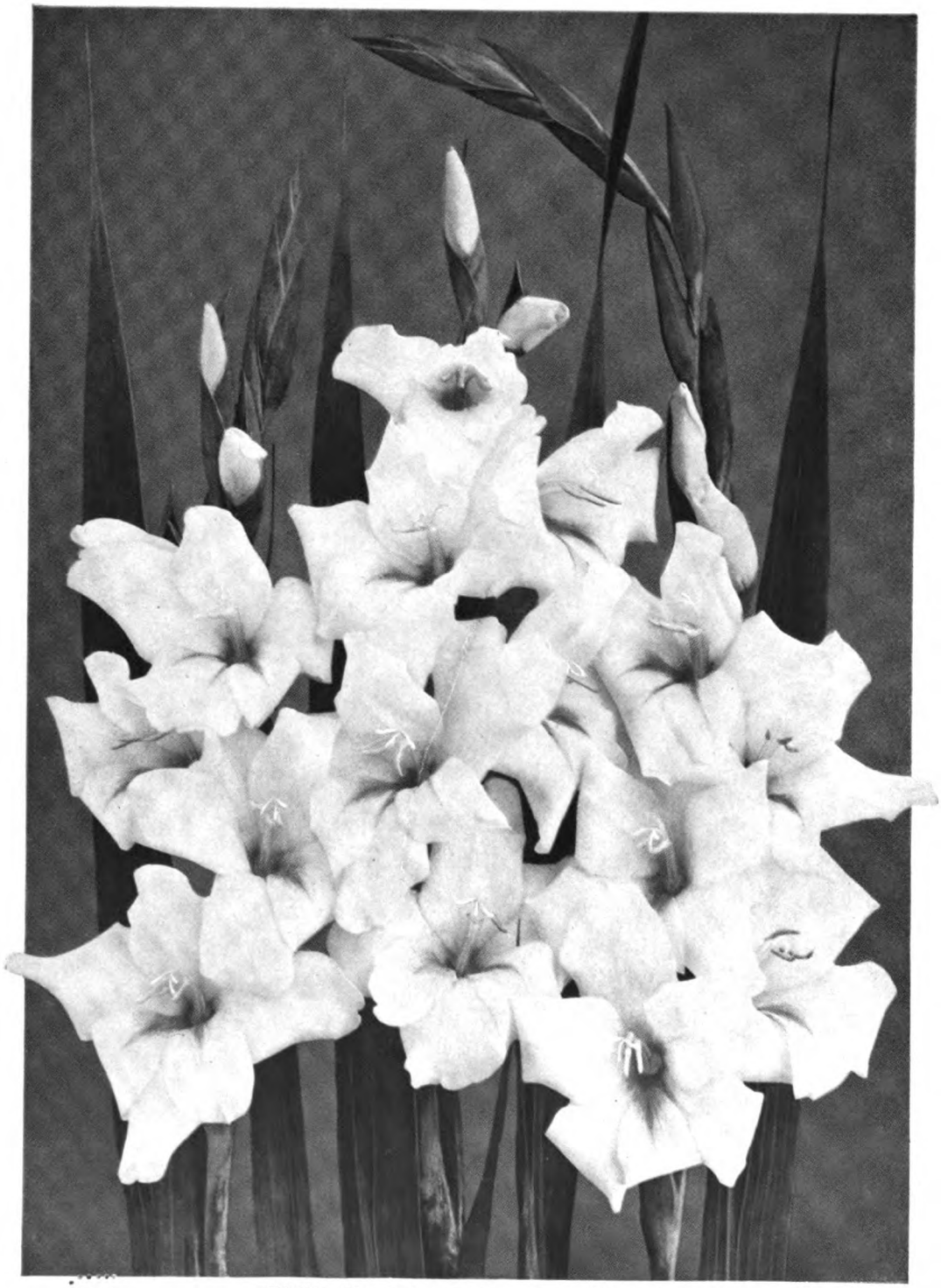

XLVIII. The garden gladiolus, variety "Peace."

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The kinds of gladiolus.

The following account includes those species that appear to have any particular horticultural history; also some of the prominent Latin-named hybrids, although not all these hybrids may now be in commerce.

INDEX.

Adlami, 20.
alatus, 2.
albidus, 24.
albus, 28.
angustus, 5.
atroviolaceus, 7.
biflorus, 8.
blandus, 24.
brenchleyensis, 29.
Brinerii, 33.
byzantinus, 11.
cardinalis, 15.
carneus, 10, 24.
Childsii, 32.
citrinus, 29.
Colvillei, 28.
communis, 10.
concolor, 4, 19.
cordatus, 5.
crispiflorus, 6.
cruentus, 16.
delicatissimus, 28.
dracocephalus, 21.
Engesseri, 33.
erectus, 19.
excelsus, 24.
fasciatus, 9.
floribundus, 25, 28.
Froebelii, 33.
gandavensis, 29.
grandis, 3.
Hibbertii, 24.
Hollandia, 29.
hybridus, 35.
imbricatus, 6.
Kunderdii, 37.
Leichtlinii, 14.
Lemoinei, 30.
maculatus, 19.
major, 19.
Milleri, 27.
Mortonius, 24.
namaquensis, 2.
nanceianus, 31.
nanus, 28.
natalensis, 22.
oppositiflorus, 26.
Papilio, 13.
præcox, 36.
primulinus, 19.
princeps, 35.
psittacinus, 22.
purpureo-auratus, 23.
Quartinianus, 18.
ramosus, 28.
salmoneus, 19.
Saundersii, 17.
segetum, 12.
sulphureus, 20.
superbus, 17.
trimaculatus, 5.
tristis, 4.
turicensis, 34.
undulatus, 9.
versicolor, 3.
vinulus, 9.
vittatus, 9.
Watsonius, 1.

I. Species of Gladiolus (Nos. 1–27).

Few of the original species of Gladiolus are in cultivation in their pure form. When grown at all, they are prized chiefly as oddities, or because of their botanical interest. The following species are either offered at the present time in the trade or are parents of modern garden forms:

A. *Fl. with a long, slender, cylindrical curved tube, which is enlarged in the middle; segms. nearly equal.* (*Homoglossum.*)

1. **Watsònius,** Thunb. (*Antholỳza revolùta*, Burm.). Corm 1 in. diam., globose: st. slender, 18 in. or less, with 1 long, narrow-linear and stiff lf. and 2–3 short sheathing lvs.: fls. 2–4, in a lax 1-sided spike, 2 in. or less long, bright red, the wide-spreading segms. oblong and acute, the lower ones smaller and lanceolate-falcate; stamens very short. S. Afr. B.M. 450.—Little known in this country, but offered by Dutch growers.

AA. *Fl. short and open, the tube short or scarcely any; segms. very prominently clawed, usually unequal.*

2. **alàtus,** Linn. Corm small, globose: small, the st. only 4–12 in. high, and slender: lvs. 3–4, linear and rigid: fls. 3–4 in a lax spike, the curved tube ½in. long, the perianth pink and often strongly veined; segms. very unequal, the 3 lower tongue-like and protruded, the others obovate or nearly orbicular, all of them differently colored toward the base; stamens nearly as long as upper segms. S. Afr. B.M. 586; 592; the var. **namaquênsis,** Baker, which is more robust, with broader lvs., more fls., the upper segms. broad.

AAA. *Fls. of medium length, with a funnel-shaped tube, which is flaring at the top; segms. narrowed below, but not distinctly clawed.* (*Gladiolus proper.*)

B. *Lvs. linear* (*½in. or less wide*).

C. *Perianth-segms. acute.*

3. **grândis,** Thunb. (*G. versicolor*, Andr.). Corm globose, with coverings of thick wiry fibers: st. slender, 2 ft. or less, terete: lvs. about 3, terete, strongly ribbed, 1½ ft. or less long: fls. 6 or less in a lax 1-sided spike, 3 in. long, with a curved tube; segms. nearly equal, oblong-lanceolate and cuspidate, as long as the tube and twice longer than the stamens, recurved and often wavy, yellowish or creamy, tinged and striped with purple-brown, especially on the keel: caps. oblong, 1½ in. long; seeds winged. S. Afr. B.M. 1042.

4. **trîstis,** Linn. Very like the last: fls. 2–4, somewhat smaller (2 in. or less long); segms. shorter than the tube and not twice longer than the stamens, acute (short-pointed), yellowish white with purple or blackish pencilings, or var. **cóncolor,** Hort., Fig. 1648 (*G. cóncolor*, Salisb.), almost white or uniform yellow. S. Afr. B.M. 272, 1098. G. 21:649. Gn. 75, p. 420. G.C. III. 38:187 (var. *concolor*). G.F. 8:75 (reproduced in Fig. 1648). —Said to exhale a powerful and delightful lemon perfume at night.

5. **angústus,** Linn. (*G. trimaculàtus*, Lam. *G. cordàtus*, Thunb.). Corm globose: slender: st. 2–3 ft., simple: lvs. 3–4, very narrow, flat, 2 ft. or less long: fls. 2–6 in a very loose spike, long-tubed, white, the oblong segms. shorter than the tube and the 3 lower ones with a characteristic purple median line ending in a heart-shaped or spade-shaped mark; stamens half length of limb. S. Afr. B.M. 602.

CC. *Perianth-segms. obtuse.*

D. *Color purple or violet.*

6. **crispiflòrus,** Herb. (*G. imbricàtus*, Linn., var. *crispiflòrus*, Baker). St. 1–2 ft., rather slender: lvs. 2–3, sometimes ½in. broad: fls. 4–10, the tube ¼in. long and curved, the segms. obovate (1 in. long), crisped or wavy on the edge, dark purple, more or less marked with white and red: seeds winged. E. Eu. and W. Asia.—Hardy or nearly so.

7. **atroviolàceus,** Boiss. Corm ovoid, ¾in. or less diam.: st. 1–2 ft. high: lvs. 3, closely ribbed, firm: fls. few, the tube ½in. long and curved, the obovate segms. 1 in. long and dark purple or violet-blue: seeds globose, not winged. W. Asia. G.C. III. 41:378.—Hardy or nearly so.

8. **biflòrus,** Klatt. Corm globose, small (½in. diam.): dwarf (1 ft. or less), the st. slender and terete and bearing only 1 well-formed lf., which is subterete and very narrow and 5–6 in. long, the 2 upper lvs. rudimentary: fls. 2–3, lilac, the tube nearly straight, the oblong segms. twice as long as the tube; stamens reaching half-way the limb. S. Afr.—Connects with Geissorhiza.

DD. *Color (under-color) white or nearly so.*

9. **vittàtus,** Hornem. (*G. vinulus*, Klatt. *G. fasciàtus*, Roem. & Schult. *G. undulàtus*, Schneev.). Corm globose: plant low (about 1 ft.): lvs. 3–4, very narrow: fls. 3–6 in a lax spike, nearly erect, the slightly curved tube nearly or quite an inch long, the limb longer than the tube, pink, the 3 lower segms. with a purple central blotch; stamens reaching half-way the limb. S. Afr. B.M. 538 (as *G. undulatus*, var.)

BB. *Lvs. ensiform* (*½in. or more broad, and flat or flattish*).

C. *Under- or body-color essentially purple.*

10. **communis,** Linn. Corm about ¾in. diam.: st. 1½–2½ ft.: lvs. 3–4, 1 ft. or less long: fls. 4–8, small (1½ in. long), with a curved tube; segms. bright purple (flesh-colored in the var. *carneus*), nearly equal in length, all connivent or touching (making a narrow fl.), the 3 lower ones long-clawed and with a median line: seeds broad-winged. France, Germany. B.M. 86, 1575.—Hardy; little known in cult. in this country. Variable; Nos. 11 and 12 are by some considered to be forms of it.

11. **byzantînus,** Mill. Fls. more and larger, plant more robust than in No. 10, segms. more spreading at maturity, although the 3 upper ones are contiguous, dark purple, the 3 lower ones with a prominent white median line: seeds winged. Medit. region. B.M. 874.—Hardy; little known in gardens.

12. **ségetum,** Ker. Differs from *G. byzantinus* in having globular (not winged) seeds, and in the flaring or spreading segms. of the bright purple, obovate-obtuse sepals. Canaries and Medit. region. B.M. 719. —Hardy and early; little grown.

13. **Papílio,** Hook, f. Corm of medium size, globose: st. 2 ft. or more: lvs. about 4, rigid, 1 ft. or more long and 1 in. or less wide: fls. 6–12, pale purple or lilac, yellow in the throat; perianth horizontal, the curved tube ¼in. long and broadly funnel-shaped at the top; 3 upper segms. obovate-spatulate, uppermost not reflexing, ½–¾in. broad, 1½ in. long, the lower ones very narrow below and marked with large red-brown spade-shaped yellow-edged blotches. S. Afr., in the Transvaal, Orange Free State and Natal. B.M. 5565.—Handsome. Varies to white in cult.

cc. *Under- or body-color essentially red (No. 22 may be sought here).*

14. **Leichtlinii,** Baker. Corm large and globose: st. about 2 ft. tall, terete: lvs. about 4, ensiform, 1 ft. long: fls. 6–8, large, in a somewhat dense 1-sided spike, bright red, with a curved tube 1¼ in. long; upper segms. obovate and connivent, equaling the tube, 3 lower ones much smaller and acute, spreading, red at tip but yellow and minutely red-dotted below; stamens shorter than upper segms. Transvaal.

15. **cardinàlis,** Curt. Corm large and globose: st. 3–4 ft.: lvs. 4–6, glaucous-green, ensiform, nearly or quite 1 in. broad and reaching 2 ft. or more in length:

1649. Gladiolus purpureo-auratus. (×⅓)

fls. many (sometimes 20), nearly erect, bright scarlet, the tube 1½ in. long and nearly straight; upper segms. oblong-spatulate (2 in. long), scarlet, the 3 lower ones shorter and narrower, with a large white blotch; stamens more than half the length of the limb. S. Afr. B.M. 135.

16. **cruéntus,** Moore. Corm large, globose: st. 2–3 ft.: lvs. about 4, ensiform, dark glaucous-green, 2 ft. or less long, ¾–1 in. broad: fls. 6–10 in a rather dense distichous spike, bright scarlet; tube 2 in. or less long, nearly straight; upper segms. obovate-spatulate, to 2½ in. long; 3 lower segms. 1½ in. long, white-blotched and red-spotted; stamens reaching half-way of limb. Natal. B.M. 5810.—Closely related to No. 15.

17. **Saûndersii,** Hook. f. Corm large, flattened-globose: height 2–3 ft.: lvs. 4–6, strongly ribbed and stiff, 1–2 ft. long and 1 in. or less broad: fls. 6–8, large, bright scarlet, the tube 1–1½ in. long and curved; 3 upper segms. oblong-spatulate, uniform scarlet, connivent (2 in. long), 3 lower smaller, white-blotched and scarlet-spotted. S. Afr., coast region to Transvaal. B.M. 5873. Gn. 12:64.—Handsome. Var. **supérbus,** Hort., is a form produced by the early infusion of *G. Saundersii* into the garden strains.

18. **Quartiniànus,** Rich. Corm to 1½ in. diam., globose: strong, 2–4 ft.: lvs. 3–4, rigid, sometimes nearly ensiform, the lower ones 1½ ft. or less long, and ¾in. or less broad: fls. 4–9, in an open spike, large, blood-red, the narrow curved tube 1½ in. long; upper segms. hooded, the other smaller and more or less reflexed; stamens nearly equaling upper segms. Nile Land to Lower Guinea and Mozambique. B.M. 6739. G.C. III. 24:467, and Gn. 55:388 (var. *superbus*). Trop. Afr.—One of the best of the genus. Named for M. Quartin Dillon, who discovered it in Abyssinia.

ccc. *Under- or body-color at least, yellow.*

19. **primúlinus,** Baker. Very like No. 18 (with which Baker subsequently united it), but differs in the yellow color: corm globose, 1 in. and more diam.: lvs. about 3, ensiform, 1½ ft. long and to 1 in. broad: fls. 3–5, in a lax secund spike, clear primrose-yellow throughout; tube 1 in. long, much curved above; 3 upper segms. ovate or obovate, acuminate, hooded, 2 in. long and more than 1 in. wide, the central one covering the stamens and stigmas; 3 lower segms. deflexed and much smaller; style exceeding the stamens. Trop. Afr., occurring in the rain-forests. B.M. 8080. G.C. III. 36:191; 42:291. R.H. 1908, p. 9.—A handsome species, and although not discovered until 1887 and flowered under cult. in 1890, it is now much used as a parent in breeding. Several varieties are offered, as var. **maculàtus,** Lemoine, with fls. large, chrome-yellow, the inner surface of the reflexed segms. bearing a maroon-red spot. Var. **salmòneus,** Lemoine, with fls. saffron or salmon-color outside, the interior bright chrome-yellow, with fine purple lines. Var. **màjor,** Lemoine, large-fld., said to be a cross of *G. primulinus* and yellow *G. Lemoinei:* fls. chrome-sulfur-yellow with light brown marks on the interior of the segms.: plant strong. Var. **eréctus,** Lemoine. Erect, with large scarcely hooded chrome-yellow maroon-spotted fls. Var. **cóncolor,** Lemoine. Fls. large, 2 of the segms. sulfur-yellow and the remainder naples-yellow.

20. **sulphùreus,** Baker. Corm 1 in. diam., globose: stout, but low, the st. 1 ft.: lvs. 3–4, the blade short (2–3 in.) and somewhat ensiform: fls. 6–8, large, soft bright yellow, the curved tube 1½ in. long, upper segms. hooded, oblong or obovate, the 3 lower ones small; stamens shorter than upper segms. E. Trop. Afr.—The *G. sulphureus,* De Graaf (*G. Adlami,* Baker) is another species and the name is older. B.M. 7791.

21. **dracocéphalus,** Hook. f. Corm large, flattened-globose: st. stout and simple, 2 ft. or less: lvs. 3–4, rather firm, 1–1½ ft. long and 1 in. or less broad: fls.

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3–6, of medium size, yellowish green, the tube (2 in. or less long) curved; upper segms. elliptic-obovate, hooded, yellowish and closely striate with purple, the other segms. much smaller and reflexing, mostly green and purple-spotted; stamens nearly equaling the segms. Natal. B.M. 5884.—Odd.

22. **psittacìnus,** Hook. (*G. natalénsis*, Reinw. *Watsònia natalénsis*, Eckl.). Corm very large, flattened-globose: st. 3 ft. or more, stout: lvs. about 4, rather rigid, 1–2 ft. long and 1–2 in. broad: fls. many and large, with a curved tube nearly or quite 2 in. long, in general effect rich yellow but thickly grained and overlaid with red (particularly about the margins of the segms.); upper segms. obovate and hooded, dark crimson, the lower much smaller and reflexing, red and yellow mixed. S. Afr., away from the coast. B.M. 3032. B.R. 1442. L. B. C. 18:1756.—One of the leading parents of garden gladioli.

1650. Gladiolus turicensis. (×⅓)

23. **purpùreo-auràtus,** Hook. f. Fig. 1649. Corm large, globose: st. 3 ft., very slender: lvs. 3–4, short: fls. 10 or more, primrose-yellow, medium in size, the curved tube less than 1 in. long; segms. obovate, not widely spreading, the lower ones with a red-brown blotch; stamens reaching half-way up the limb. Natal. B.M. 5944. G.F. 2:89 (reduced in Fig. 1649).—Handsome. A parent of modern gladioli. Suggested by Baker as perhaps a color-variety of *G. Papilio*.

cccc. *Under- or body-color white. (Forms of No. 13 may be sought here.)*

24. **blándus,** Ait. Corm medium size, globose: st. 2 ft. or less tall, sometimes branched: lvs. usually 4, 1 ft. or less long and ½–¾in. wide: fls. few, white and red-tinged, the curved tube 1½ in. long; segms. all oblong or oblong-spatulate and flaring or recurved, some of them red-marked in the throat; stamens more than half length of limb. S. Afr., coast region; variable. B.M. 625. Sometimes pure white. B.M. 648, *G. álbidus*, Jacq.; pink or flesh-color, B.M. 645; *G. cárneus*, Delar.; segms. white, with many pink markings, B. M. 3680, *G. Mortònius*, Herb.; taller, with longer lvs. and perianth-tube, *G. excélsus*, Sweet; pink fls. with red blotches on 3 lower segms., var. *Hibbertii*, Hort. *G. blandus* is an old garden plant.

25. **floribúndus,** Jacq. Corm globose: st. 2 ft. or less, often branched: lvs. usually 4, ensiform, 1–2 ft. long: fls. 12 or less, ascending, in a lax 2-sided spike, large, white tinged with pink, the slightly curved tube 2 in. or less long; segms. obovate or spatulate, obtuse or deltoid, wide-flaring, red-lined; stamens one-third or one-half length of limb. S. Afr., coast region; perhaps a form of *G. blandus*. B.M. 610.

26. **oppositiflòrus,** Herb. Much like the last, but fls. more numerous and smaller, white, sometimes marked with rose, the segms. oblong and distinctly pointed. S. Afr., in the eastern region. B.M. 7292. G.C. III. 13:291. Gn. 45:440.—A very handsome plant, growing 3–6 ft. high, and said to produce spikes 2 ft. long.

27. **Mílleri,** Ker (*Antholìza spicàta*, Mill.). Corm medium size, globose: st. 12–20 in., simple: lvs. about 4, ensiform, shorter than the st.: fls. rather large, 4–5, nearly erect, milk-white, the tube 2 in. or less long and straight; segms. oblong and nearly acute; stamens one-third to one-half length of limb. S. Afr., coast region. B.M. 632.

II. Hybrids and Variants of Gladiolus in Cultivation.

The garden gladioli are derivatives of various kinds and degrees. Of many, the parentage is so confused that it cannot be made out. However, there were four early main lines of development or divergence, represented in the late-flowering *G. gandavensis*, *G. Lemoinei* and *G. nanceianus*, and the early-flowering *G. Colvillei*. To these have been added other lines in recent years.

28. **Cólvillei,** Sweet (*G. tristis* var. *cóncolor* × *G. cardinàlis*). Fls. open or flaring, with oblong-acute segms.; scarlet, with long blotches at the base of the lower segms: early-flowering: spikes short. Hardy south of Washington with some protection. R.H. 1895, p. 289. G.C. III. 12:90. Gn. 28:566; 34:580; 50, p. 66. Gn.M. 4:189.—The oldest of the garden forms. Runs into many types and strains. The modern white-fld. type, var. *álbus*, represented by The Bride, is best known in this country. Small forms are known as *G. nànus:* Gn.W. 15:9; used for early flowering. Some forms are known as *G. floribúndus*. *G. delicatíssimus*, Blushing Bride, is a form of the same group: segms. white, with a large oval rose-crimson yellow-centered blotch on each of the 3 lower ones. Gn. W. 15:9. J.H. III. 49:213.

Another form of early-flowering gladioli is known as *G. ramòsus*, Paxt. (issue of *G. cardinalis* and *G. oppositiflorus*), but it is probably no longer possible to distinguish these two groups.

29. **gandavénsis,** Van Houtte (*G. psittacìnus* × *G. cardinàlis*). Fig. 1645. Upper segms. nearly or quite horizontal or hooded, the colors in bright shades of red and red-yellow, variously streaked and pencilled: late-flowering: spikes long. The commonest old-time type of garden gladiolus with the bloom much like that of *G. psittacinus* in form and size, but with a purer and better red. F.S. 2:84 (1846). R.H. 1846:141. P.M. 11:27. Gn. 64, p. 252. H.F. 1:208; 2:132. Gt. 59, p. 499 (var. *Europa*, with pure white fls.)—First offered to the trade by Van Houtte, Aug. 31, 1841. M. Souchet, of Fontainebleau, France, did much to improve the gandavensis type by repeated selections and breeding. By Herbert and some others, gandavensis is considered to be an offspring of *G. psittacinus* × *G. oppositiflorus*. Var. *citrìnus*, Hort., is like *G. psittacinus*, but the color is bright yellow. F.S. 5:539. *C. brenchleyénsis* is one of the gandavensis tribes; light red. *G. Holländia* is a pink form of this.

30. **Lemòinei,** Hort. (*G. gandavénsis* × *G. purpùreo-auràtus*). Fig. 1646. A modern race characterized by highly colored yellow, red and purplish fls., purple-blotched on the lower segms. with a more or less bell-shaped form of corolla—the segms. broad and heavy and the upper ones horizontal or strongly hooded. Grown by M. Lemoine, Nancy, France, and first shown at the Paris Exhibition of 1878. Gn. 17:306; 30:76. R.H. 1879:330.—Fls. said not to open up so well when cut as do those of *G. gandavensis*, the st. being hard.

31. **nanceiànus,** Hort. (*G. Lemòinei* × *G. Saùndersii*). Fig. 1646. Robust, with very large, open-spreading fls.,

the 2 side segms. widely flaring and sometimes measuring 6–8 in. from tip to tip; upper segm. long and upright. First exhibited by Lemoine, the raiser, in 1889. The finest race, characteristically is full-open and large fls., in brilliant shades of red and purple. Gn. 41:190. G.C. III. 13:131. Gn. W. 7:797.

32. **Childsii** (*G. gandavénsis* × *G. Saùndersii*). Fls. wide open and large, with very broad petals: st. large and soft, taking up water well when fls. are cut. Originated by Max Leichtlin, Germany.

33. **Froèbelii,** Hort., is *G. purpùreo-auràtus* × *G. gandavénsis;* **G. Engésseri,** Hort., is of similar parentage; also **G. Brìneri,** Hort.

34. **turicénsis,** Hort. (Fig. 1650), is the offspring of a large-fld. *G. gandavensis* and *G. Saundersii* var. *superbus*. It is a fine purplish crimson, the lower segms. being beautifully marked with white: fls. 3 in. across. G.F. 3:89 (reduced in Fig. 1650).—This and the last 3 are the work of Froebel & Co., Zurich.

35. **prìnceps,** Hort. (*G. hýbridus prìnceps*). Produced by W. W. Van Fleet, from seed of *G. cruentus* × *G. Childsii;* like the seed-parent in its scarlet-crimson coloring, with white and cream feather markings on the lower segms.: very large, the flat circular bloom expanding to 6 in. diam.: plant very large. G. 24:663; 34:533. Gn. 60, p. 197. G.M. 44:629.

36. **prècox,** Hort. Very early-flowering types, results of crossing of horticultural groups (p. 1340).

37. **Kúnderdii,** Hort. A strain or group of the ruffled or fluted kinds. See p. 1340.

Many species of Gladiolus are likely to be discussed in horticultural literature. The following have recently been prominently mentioned: *G. carmíneus*, C. H. Wright. Resembles R. ramosus, Paxt., but differs in its laxer habit, longer spathe and yellow anthers: slender, 1½ ft.: lvs. linear, acuminate, 8 in. long and ½in. broad: fls. carmine, about 3 in. across; tube narrow-funnel-shaped, white outside; segms. ovate, acuminate, 2 of the inner bearing a dark spot with a pale center; stamens rather more than half length of perianth. S. Afr. B.M. 8068.—*G. glaùcus*, Heldr. Dwarf, not exceeding 12 in.: st. and lvs. erect and stiff: fls. many, bluish red with red and white stripes at base. Greece.—*G. Macklnderi*, Hook. f. St. slender, 2 ft.: lvs. narrowly linear, the lower about 1 ft. long: fls. 5–6, the tube yellow, broad segms. scarlet and 1½ in. across. E. Trop. Afr. B.M. 7860. Named for Professor Mackinder, Oxford, who collected seeds at 10,000 ft. on Mt. Kenia in 1900. One of the Homoglossum section. L. H. B.

1651. Glaucium flavum. (×⅓)

GLASSHOUSE. Any glass structure in which plants are grown, particularly one that is large enough to admit the operator. It is a generic term. See *Greenhouse.*

GLAÚCIUM (name refers to glaucous foliage). *Papaveràceæ.* Horned Poppy. Annual, biennial or occasionally perennial herbs, a few of which are grown for their large poppy-like flowers and glaucous-blue foliage.

Sepals 2; petals 4; stamens many; ovary with 2 (rarely 3) cells, the stigmas miter-shaped, the fr. becoming a long silique-like caps.: lvs. alternate, lobed or dissected.—A dozen or more species of S. Eu. and W. Asia.

Glauciums are low, branchy herbs, often somewhat succulent, with large flowers, mostly yellow or orange, but varying to red and purple. The flowers are usually short-lived, but they are borne in rapid succession. They are well adapted for foliage effects in borders or edgings. Of easy culture in any good soil. They prefer an open, sunny situation. Mostly propagated by seed, but the perennial kinds by division; however, the perennials are short-lived, and usually had best be treated as biennials; they should be grown from seed. Hybrids are announced by Burbank.

flàvum, Crantz (*G. lùteum*, Scop.). Horn Poppy, or Sea Poppy. Fig. 1651. Sts. stout, 1–2 ft., pubescent: radical lvs. 2-pinnate and hairy, the upper clasping and sinuate-pinnatifid and cordate at the base: fls. generally solitary, on long sts. 2–3 in. across, yellow or orange. Eu. C.L.A. 1:139. Gn. M. 9:86.—Sparingly naturalized E. Perennial or biennial; sometimes grown as an annual. Var. **trìcolor,** Hort. (*G. trìcolor*, Vilm.) has been advertised. It has parti-colored fls. and is showy. G.C. III. 36:115. G.M. 48:697. Gn. 66, p. 59.

corniculàtum, Curt. (*G. phœnìceum*, Gaert. *G. rùbrum*, Hort.). Lower: radical lvs. pinnatifid, pubescent, the upper ones sessile and truncate at the base: fls. red or purplish, with a black spot at the base of each petal. Eu.—Mostly annual. *G. Fischeri*, Hort., is probably a form of this.

leiocárpum, Boiss. A velvety perennial with oblong, sinuate-dentate, or much-divided lvs. which in the upper part of the plant are sinuate-lobed: fls. yellow, the calyx somewhat papillose. Medit. region.—Scarcely a showy member of the genus. L. H. B.
N. Taylor.†

GLAÙX (Greek, *sea-green*). *Primulàceæ.* One small little pale herb, seldom seen in gardens, *G. marìtima*, Linn. St. 9 in. or less high, erect or spreading, perennial by slender creeping rootstocks, growing in salt marshes and seacoasts from New Jersey and Calif. northward, and also in Eu. and Asia: lvs. oval to oblong-linear, entire and sessile, ½in. or less long: fls. purplish or white, the corolla wanting; calyx with 5 petal-like lobes; stamens and style exhibiting dimorphism: fr. a 5-valved few-seeded caps. L. H. B.

GLAZIÒVA: *Cocos insignis.*

GLECHÒMA: *Nepeta.*

GLEDÍTSIA (after Gottlieb Gleditsch, director of the botanic garden at Berlin; died 1780). Syn. *Gleditschia. Leguminòsæ.* Honey Locust. Ornamental trees grown chiefly for their handsome finely divided foliage; also the large conspicuous pods and the branched spines are attractive.

Deciduous, usually with large branched spines on trunk and branches: lvs. without stipules, alternate, abruptly pinnate, often partly bipinnate on the same lf. or wholly bipinnate, both usually on the same tree: fls. polygamous in racemes or rarely panicles; calyx-lobes and petals 3–5, petals nearly equal, not much longer than calyx, stamens 6–10; style short, with large terminal stigma: pod compressed, mostly large and indehiscent, 1- to many-seeded.—About 12 species in N. Amer., E. and Cent. Asia, in Trop. Afr. and in S. Amer.

The honey locusts are large trees with spreading branches forming a broad graceful rather loose head, with finely pinnate foliage, generally light green and turning clear yellow in fall; the greenish flowers appearing in racemes early in summer are inconspicuous, but the large, flat pods are ornamental and the fertile tree is therefore to be preferred for planting. *G. triacanthos*

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is a useful native and is hardy North; *G. japonica* is almost hardy North, while *G. Delavayi* and *G. sinensis* are tender. They are very valuable trees for park planting and for avenues, and make almost impenetrable hedges if planted thickly and pruned severely. The coarse-grained wood is durable and strong. The pulp of the pods of *G. triacanthos* is sweet when fresh, hence the name honey locust, but becomes bitter at length; that of *G. japonica* is used in Japan and that of *G. sinensis* and *G. macracantha* in China as a substitute for soap. The gleditsias are of vigorous growth and thrive in almost any soil; they stand drought well. Propagation is by seeds sown in spring about 1 inch deep; they should be soaked in hot water before being sown; varieties and rare kinds are sometimes grafted on seedlings of *G. triacanthos* in spring.

1652. Gleditsia triacanthos. (×⅓)

A. *Spines more or less compressed, at least at the base: walls of pod papery or leathery: lvs. pinnate with more than 12 lfts., or bipinnate.*

B. *Pod 1–2-seeded, oval, not pulpy.*

aquática, Marsh. (*G. inérmis,* Mill., not Linn. *G. monospérma,* Walt.). Water or Swamp Locust. Tree, to 60 ft., with short trunk, spiny: lvs. 12–18-foliolate or doubly pinnate with 6–8 pinnæ; lfts. ovate-oblong, usually rounded or sometimes emarginate at the apex, slightly crenate and often entire below the middle, glabrous except a few hairs on the petiolules, about 1 in. long: fls. in racemes; ovary glabrous: pods long-stalked, 1–2 in. long. May, June. S. C. and Ky. to Fla. and Texas. S.S. 3:127, 128.

BB. *Pod many-seeded, elongated and usually more or less twisted, pulpy.*

C. *Lfts. usually acute or acutish, often more than 20, not over 1½ in. long: ovary pubescent.*

triacánthos, Linn. Honey or Sweet Locust. Three-thorned Acacia. Fig. 1652. Tree, 70–140 ft., usually with stout simple or branched spines 3–4 in. long: lvs. 6–8 in. long, with pubescent grooved rachis; pinnate with 20–30 lfts., bipinnate with 8–14 pinnæ; lfts. oblong-lanceolate, remotely crenulate-serrate, ¾–1½ in. long: fls. very short-pedicelled in 1½–3 in. long, narrow racemes; ovary pubescent: pod 12–18 in. long, slightly falcate and twisted at length. May, June. From Pa. south to Miss., west to Neb. and Texas. S.S. 3:125, 126. Gn. 32, p. 304. Var. **inérmis,** Pursh. Unarmed or nearly so, of somewhat more slender and looser habit; var. **inérmis elegantíssima,** Grosdemange, is an unarmed form of dense bushy habit and with smaller lfts. R.H. 1905, p. 513. Var. **Bujótii,** Rehd. (*G. Bujótii,* Neum. *G. Bujótii péndula,* Hort.). With slender, pendulous branches and narrower lfts.

CC. *Lfts. obtuse or emarginate, usually less than 20: ovary glabrous or only pubescent on the margin.*

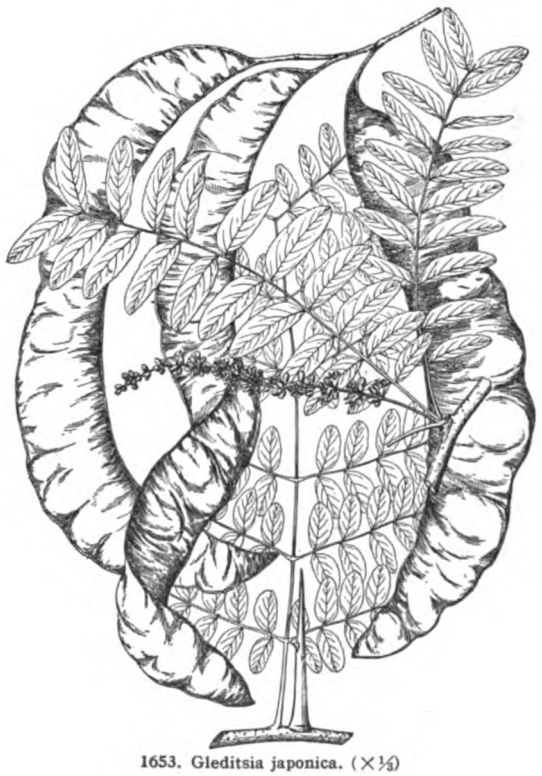
japónica, Miq. (*G. hórrida,* Makino). Fig. 1653. Tree, 60–70 ft., with somewhat compressed, often branched spines, 2–4 in. long: lvs. 10–12 in. long, with grooved and slightly winged, puberulous rachis, pinnate with 16–20 lfts., bipinnate with 8–12 pinnæ; lfts. ovate to oblong, nearly lanceolate, obtuse, entire or remotely crenulate, lustrous above, ¾–2 in. long: fls. short-pedicelled, in slender racemes: pod 10–12 in. long, twisted, bullate, with the seeds near the middle; pulp acid. Japan, China. G.F. 6:165 (adapted in Fig. 1653). Var. **purpùrea,** Rehd. (*G. sinénsis* var. *purpùrea,* Loud. *G. coccínea,* Hort. *G. sinénsis* var. *orientàlis,* Hort.). Lfts. broadly oval to oblong-oval, obtuse or emarginate, ½–1½ in. on the pinnate, smaller on the bipinnate lvs.

Delavàyi, Franch. Tall tree: spines compressed at the base, to 10 in. long: lvs. 12–18-foliolate, only on young plants partly bipinnate; lfts. obliquely ovate or ovate-oblong, obtuse or emarginate, slightly crenate or nearly entire, dark green and lustrous above, glabrous, to 2½ in. long, the lower much smaller, also much smaller on young plants: fls. in slender racemes; ovary glabrous: pod with leathery walls, to 15 or sometimes to 20 in. long and to 2⅓ in. broad, twisted. S. W. China.—Very handsome; recently intro.

AA. *Spines terete: walls of pod thick, woody; pod straight or falcate, not twisted: lvs. 8–16-foliolate, very rarely bipinnate.*

sinénsis, Lam. (*G. hórrida,* Willd.). Tree, to 40 ft., with stout conical often branched spines: lvs. 5–7 in. long, with grooved pubescent rachis, and 8–18 lfts.; lfts. ovate or oblong-ovate, obtuse or acute, crenulate-serrate, yellowish green, dull above, reticulate beneath, ¾–2 in. long: fls. distinctly pedicelled, in slender racemes; ovary glabrous: pod almost straight, thick, 4–7 in. long, 1–1½ in. broad. China. Var. **nàna,** Loud. Shrubby and less spiny, with smaller and narrower lfts.

G. amorphoides, Taub. (Garugandra amorphoides, Griseb.). Tree, to 50 ft., very spiny: lfts. obliquely ovate to linear-oblong, ¼–1 in. long: fls. in racemes: pod oblong, falcate, 3–4 in. long, 1 in. broad, ⅛in. thick. Argentina, Bolivia. Cult. in Calif.—*G. australis,* Hemsl. Tree with large spines: lfts. very oblique, oblong, crenate, leathery, shining: pod with coriaceous walls, 4–5 in. long. S. China. —*G. caspica,* Desf. (G. horrida var. caspica, Schneid.). Allied to G. japonica. Lvs. pinnate with 12–20 ovate, crenulate lfts., or bipin-



1653. Gleditsia japonica. (×⅓)

nate with 6–8 pinnæ: pod thin, pulpy, to 12 in. long.—*G. férox*, Desf. Allied to G. sinensis. Spines very stout: lvs. 16–30-foliolate; lfts. oblong-ovate to oblong-lanceolate, crenate, ½–1½ in. long: pod to 10 in. long. China. Most plants cult. under this name seem to belong to G. japonica.—*G. Fontanèsii*, Spach=G. macracantha.—*G. heterophýlla*, Bunge. Allied to G. aquatica: lfts. obliquely obovate, pubescent below, ½–¾in. long: pod oval, 2–3-seeded, slender-stalked, about 1 in. long. N. China. Probably quite hardy.—*G. macracántha*, Desf. Allied to G. sinensis. Spines and lfts. generally larger: infl. paniculate; ovary pubescent: pod 4–6 in. long, ¾in. broad, often almost cylindrical. China.—*G. officinàlis*, Hemsl. Allied to G. sinensis. Spiny tree, to 40 ft.: lfts. 12–20, obliquely elliptic to elliptic-oblong, acutish, to 3½ in. long: pod oblong, thick, falcate, 3–4 in. long and little over ½in. broad. Cent. China.—*G. texàna*, Sarg. Allied to G. triacanthos. Lvs. 12–22-foliolate, often bipinnate: pod narrow-oblong, straight, 4–5 in. long. Texas. S.S. 13:627. Possibly hybrid of G. aquatica and G. triacanthos.

ALFRED REHDER.

GLEICHÈNIA (W. F. Von Gleichen, 1717–1783). *Gleicheniàceæ*. Ferns mainly from the tropical and south temperate zones, growing naturally in dense thickets; one species has recently been found in Louisiana, *D. flexuosa*. (Amer. Fern Jour. 4:15).

The family is characterized by dorsal sori composed of a few nearly sessile sporangia; each sporangium is surrounded by a broad transverse ring, and opens vertically. The most striking thing about the family is the growth of the lvs. The lvs. of many of the species are perennial and show an indeterminate growth. During the growing season, the end of the lf. will keep unrolling after the usual manner of ferns. During the resting season this tip rests, but resumes its growth the next season. The lvs. of some species may thus become over 100 ft. in length. The species after the third (AA) are often catalogued under Mertensia, a name which, because used for a genus of flowers, must give way to Dicranopteris if they are separated and placed in a distinct genus, where they probably belong.

A. *Ultimate lobes small, roundish.*

B. *Sorus of 3–4 sporangia, superficial.*

rupéstris, R. Br. Lobes rounded or obtusely quadrangular, the margins thickened and recurved, somewhat glaucous beneath. Austral. Var. **glaucéscens,** Moore, has lvs. of thicker texture, which, when young, are very glaucous on both sides, contrasting with the reddish purple stalks.

circinàta, Swartz. Lobes ovate or rotund, with the rachides pubescent when young; 3–5 times forking, the ultimate pinnules 1 in. long. Austral., New Zeal.

Var. **spelúncæ,** Hort. (*G. spelúncæ*, R. Br.). Lvs. pendent but not curving; pinnules curved inward, forming small cavities. Var. **semivestìta,** Labill. (*G. semivestìta*, Hort.), differs in its close and very erect habit, and flat, deep green pinnæ. Var. **Méndellii,** Moore (*G. Méndellii*, Hort.). More robust and compact than the type, with flat, thicker and glaucous lvs. Gn. 51, p. 472.

BB. *Sorus of 2 sporangia concealed in slipper-shaped lobes.*

dicárpa, R. Br. Lvs. 2–4 times forked, with the lobes strongly arched, rotund or narrow, with the under surface rusty-hairy. Austral.

AA. *Ultimate lobes pectinate: sori near the middle of the veinlets.*

B. *Lf. after first forking, bipinnate.*

glaùca, Hook. Primary branches elongate, 2–3 ft. long: rachises with rusty scales; pinnæ 4–8 in. long, with closely placed entire segms., glaucous beneath. China and Japan.

BB. *Lf. with fan-shaped divisions.*

flabellàta, R. Br. Lvs. 2–3 times forked, the divisions ascending, 6 in. or more long, elliptic-lanceolate; ultimate divisions linear. Austral.

longipinnàta, Hook. Branches of the lvs. repeatedly dichotomous; pinnæ up to 2 ft. long, 3 in. wide. Trop. Amer.

AAA. *Ultimate branches with a pair of forked pinnæ: lf.-sts. zigzag, repeatedly dichotomous.*

dichótoma, Willd. With a distinct pair of pinnæ arising from the base of the forked branches; segms. not decurrent. Tropical regions generally, but several species have been confused here, as in many of the widely distributed species.

L. M. UNDERWOOD.
R. C. BENEDICT.†

GLIRICÌDIA (*rodent-poison*, from the seeds). *Leguminòsæ*. Eight or 10 woody plants, Cuba and Mex., to S. Amer., differing from Robinia in the wingless or marginless pods and coriaceous valves. Lvs. odd-pinnate, the lfts. entire: fls. rose-colored, racemose or fasciculate; calyx-teeth short and broad, the 2 upper ones joined; standard large, reflexed; wings falcate-oblong; keel incurved, obtuse; ovary stipitate, many-ovuled, becoming a broad-linear 2-valved pod. **G. platycárpa,** Griseb., of Cuba, is offered in S. Fla.: tree, to 25 ft.: lfts. 7–9, ovate or ovate-oblong, glabrous, the margins undulate: corolla pink or purplish; stigma ciliate: pod sessile, plano-compressed, lanceolate-oblong, 8-seeded. **G. maculàta.** HBK. (*Lonchocárpus maculàtus*, DC.), Guatemala to S. Amer., is reported as in cult. in S. Fla.: small tree: lfts. about 17, oblong, obtuse, somewhat appressed-pilose above and blackish-spotted and glaucescent beneath: pod linear, compressed, with thickened margin.

L. H. B.

GLÓBBA (Malayan name). *Zingiberàceæ*. Herbaceous conservatory plants with rhizomes and habit of canna, and a singular floral structure.

Flowers in terminal panicles; bracts usually deciduous; calyx funnel-shaped, 3-lobed; corolla-tube longer than the calyx, the lobes nearly equal, ovate; staminoid petal-like and fastened to the corolla-lobes; ovary 1-celled, forming a globose, tardily dehiscing caps.—Only one species is known to be cult. in Amer. This is known as *G. coccinea*, which is really *G. atrosanguinea*, figured at B.M. 6626. "Index Kewensis" is clearly in error in referring *G. coccinea* to *G. albo-bracteata*, as is plain from G.C. II. 18:71. Veitch intro. in 1881 a plant under the provisional name of *G. coccinea*, as it was supposed to be a new species, but the next year, it was identified with *G. atrosanguinea*. This plant was highly praised in 1893: "Plants in bloom the greater part of the year: sts. much crowded, 12–18 in. long, gracefully arching on all sides: fls. scarlet and yellow, in dense racemes." The credit for the discovery of this plant is generally given to F. W. Burbidge, but in G.C. II. 18:407, Burbidge gives the honor to Curtis. For cult., see *Alpinia*.

atrosanguínea, Teijsm. & Binn. (*G. coccínea*, Hort., Veitch). St. slender, becoming 2–3 ft. high: lvs. 3–4 in. long, elliptic, acuminate at both ends; sheaths purplish, pubescent, closely clasping the st.; lower flowerless bracts distant, brown, 6–9 lines long, upper and flowering bracts crowded, red: fls. 1½ in. long; corolla yellow, tubular, thrice as long as calyx. Borneo. B.M. 6626. G.Z. 27, p. 121.—Little known in Amer. outside of botanic gardens.

N. TAYLOR.†

GLOBE AMARANTH: *Gomphrena.*

GLOBE FLOWER: *Trollius.*

GLOBE HYACINTH: *Muscari.*

GLOBE THISTLE: *Echinops.*

GLOBE TULIP: *Calochortus.*

GLOBULÀRIA (the flowers in small, globular heads). *Globulariàceæ*. Herbs, subshrubs and shrubs, with small blue flowers mostly in spherical heads.

Leaves from the root or alternate, leathery, entire or with a few sharp teeth: fls. small, blue, in dense heads; calyx 5-lobed, sometimes obscurely 2-lipped; corolla-tube usually short, broad at the throat, the

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lobes oblique or unequal; stamens 4, didynamous, attached at the throat: fr. small, included in the calyx. —About a dozen species from the Old World. Probably the commonest and best species is *G. tricosantha*, which thrives at the front of well-drained borders, but is particularly showy in the rockery. For this and *G. vulgaris* and its forms, rather moist but well-drained soil and partial shade are advised. Prop. by division or seed.

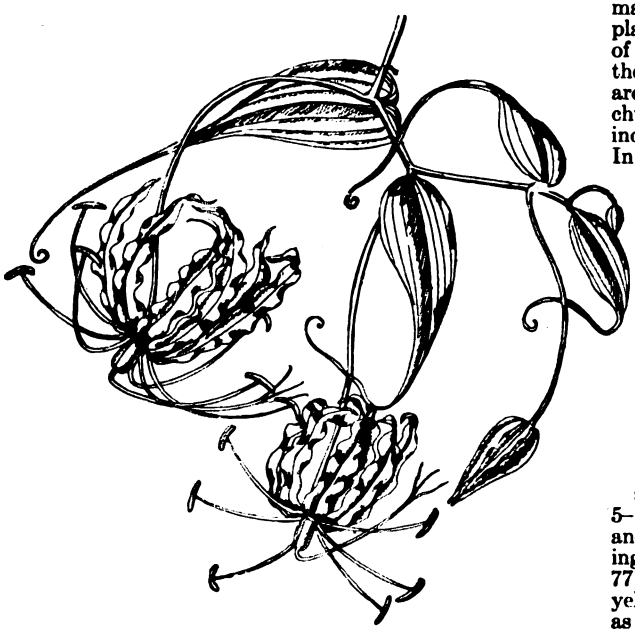
A. *Hardy herbaceous plants about 6–12 in. high.*

B. *Root-lvs. 1-nerved.*

trichosántha, Fisch. & Mey. Height 6 in.: root-lvs. spatulate, 3-toothed at apex; st.-lvs. obovate or oblong, mucronate, sessile. July, Aug. Asia Minor. Syria.

BB. *Root-lvs. 5-nerved.*

vulgàris, Linn. (*G. nudicaùlis*, Hort.). Height 8–12 in.: root-lvs. obovate, petiolate, nearly entire, apex entire, notched or mucronate; st.-lvs. lanceolate, sessile. S. Eu., Caucasus. July, Aug. B.M. 2256.



1654. Gloriosa superba. (×½)

AA. *Prostrate, woody herb, forming mats.*

cordifòlia, Linn. A low prostrate perennial with creeping, almost woody sts., and wedge-shaped, notched lvs., which form rosettes at the base of the solitary pedicel: fls. in a close head, not showy. S. Eu.—Useful for the rockery.

G. Alÿpum, Linn. Lvs. obovate-oblong, mucronate or 3-toothed at apex. Medit. regions.—Cult. years ago in S. Calif. by Franceschi, who says it is covered with fls. all winter; but not now in cult. Also cult. abroad under glass.—*G. bellidifòlia*, Salisb. = G. spinosa.—*G. spinòsa*, Linn. One ft. and more: radical lvs. obovate, attenuate into petiole, 3–7-toothed at apex; st.-lvs. lanceolate and sessile: head larger than in G. vulgaris; calyx 2-lipped, the tube ciliate and throat barbed; upper lip of corolla 2-parted, lower 3-parted. Spain.

N. TAYLOR.†

GLOCHÍDION (from Greek for *point*, the anthers being long-pointed). *Euphorbiàceæ*. Tropical trees or shrubs, rarely cult. Lvs. alternate, simple: fls. in axillary clusters or singly; staminate calyx imbricate, of 3–8 sepals; pistillate fls. without disk, stigmas short and thick, ovules 2 to each cell: fr. a caps.—About 135 species of Trop. Asia and Pacific islands, related to Phyllanthus.

J. B. S. NORTON.

GLONÈRIA: *Psychotria.*

GLORIÒSA (Latin for *glorious*). Syn., *Methónica*. *Liliàceæ*. Tall, weak-stemmed plants, supporting themselves by means of tendril-like prolongations of the leaves. Odd and handsome plants, to be grown in a warmhouse.

Leaves oblong, lanceolate or lance-ovate: fls. many and showy, long-stalked, borne singly in the axils of the upper lvs.; perianth of 6 distinct long segms. which are undulate or crisped, and reflexed after the manner of a cyclamen, variously colored; stamens 6, long and spreading, with versatile anthers; ovary 3-loculed; style long, and bent upward near the base.—Five or perhaps more tropical species, all African, and 1 also Asian.

Gloriosas are not difficult to grow. The brightest flowers are produced in sunlight. The plants grow from tubers. These tubers should be rested in early winter, and started in pots in January to March. The plants bloom in summer and fall. When potting the old tubers, offsets may be removed (when they occur) and grown separately for the production of new plants. The tubers may be cut in two for purposes of propagation. Let the plants stand near a pillar or other support. Give freely of water when the plants are growing. In this country they are sometimes bedded out in summer. Gloriosas are sometimes grown outdoors in summer in Massachusetts, and the plants so treated are not much inclined to climb and flower so freely as under glass. In Florida, they may be grown permanently in the open.

Success with gloriosa depends on having strong bulbs. Consult *Bulbs*.

A. *Perianth-segms. about 2½ in. long.*

Cársonii, Baker. St. erect and climbing, the lvs. st.-clasping, about 4–5 in. long, bearing long tendril-like processes: fls. very numerous, in a loose cyme; perianth-segms. not more than 2½ in. long, usually less than that, recurved and crisped, the margins yellow; style erect; stigmas 3.—F.S.R. 2, p. 355. A showy plant from Cent. Afr. Intro. in 1904.

AA. *Perianth-segms. longer than 3 in.*

B. *Segms. (or petals) much crisped.*

superba, Linn. CLIMBING LILY. Fig. 1654. St. 5–10 ft. high: lvs. ovate-lanceolate: segms. 2–3 in. long and less than an inch wide, opening yellow, but changing to yellow-red and deep scarlet. Afr., Asia. B.R. 77. Gn. 38:576. B.H. 23:121. G.L. 18:277.—A yellow-fld. form of unknown origin has been described as *G. lùtea*, Hort; it is scarcely known outside of Kew. Var. **grandiflòra,** Hort., is advertised as "color a yellow-red, changing to deep scarlet;" it is unknown in the wild state.

BB. *Segms. somewhat undulate, but not crisped.*

simplex, Linn. (*G. virèscens*, Lindl. *G. Plántii*, Loud.). Fls. opening yellow, and remaining so in shade, but becoming deep yellow-red when exposed to the sun; wider than in *G. superba*, barely undulate and wavy, and not prolonged or hooked at the end as in the latter species. Afr. B.M. 2539. G. 26:556. Var. **grandiflòra,** Nichols. (*Methónica grandiflòra*, Hook.), has fls. 8 in. across. B.M. 5216. G. 27:477.

Rothschildiàna, O'Brien. St. climbing, simple at first, afterward branched: lvs. bright green, glabrous, oblong-acuminate, alternate or opposite: fls. solitary in the axils, or peduncles 3–4 in. long, abruptly curved near the ovary; perianth-segms. oblong-lanceolate, recurved, over 3½ in. long, crimson, with a dark purple mark near the base. Trop. Afr.—One of the best species. G.C. III. 33:323. G.M. 47:377. Gn. 65, p. 451. G.W. 9, p. 112; 13, p. 535. R.B. 34:339. F.S.R. 2:248. Var. **citrina,** Hort., has fls. citron-yellow and claret-purple. It is a splendid showy addition. G.C. III. 38:211.

G. abyssínica, Rich., said to be the largest-fld. species, seems not to be in cult.—*G. Lèopoldii*, Hort., a beautiful form with yellow and purple fls., is probably some form of G. simplex grandiflora. G.C. III. 36:188. R.H. 1903:548. N. TAYLOR.†

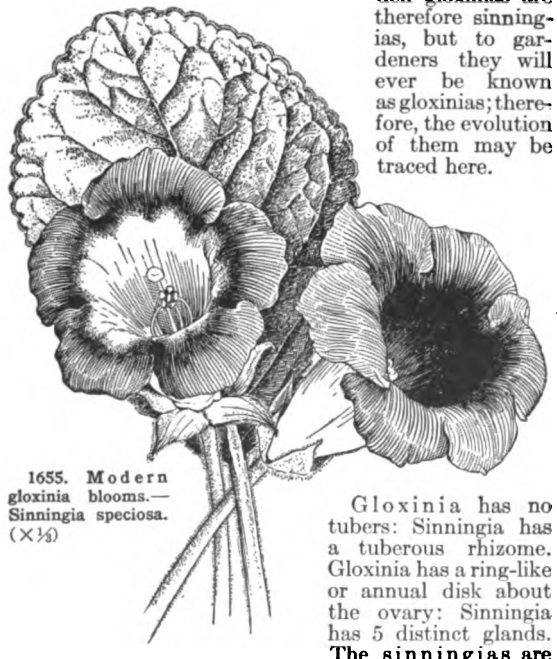
GLORY-OF-THE-SNOW: *Chionodoxa.*

GLORY PEA: *Clianthus.*

GLOSSOCÒMIA CLEMATÍDEA: *Codonopsis clematidea.*

GLOXINÈRA (*Gloxinia* and *Gesneria*). *Gesneriàceæ.* A bigeneric hybrid between *Gesneria pyramidalis* (seed-parent) and Gloxinia Radiance, by Veitch and first exhibited at the Royal Horticultural Society, London, May 8, 1894. It has the habit of a garden gloxinia, with inclined fls. of fair size, brilliant scarlet tinged with magenta in the shadows. The foliage is recorded as more nearly that of a gloxinia than a gesneria in appearance, being very succulent and covered with fine hairs. G.C. III. 17:145.

GLOXÍNIA (named for P. B. Gloxin, of Strassburg, who wrote in 1785). *Gesneriàceæ.* The genus Gloxinia was founded by L'Heritier in 1785 upon *G. maculata* of Brazil. Early in last century a related Brazilian plant was introduced, and it attracted much attention: this plant was named *Gloxinia speciosa* by Loddiges in his Botanical Cabinet in 1817, and it was there figured. In the same year it was figured by Ker in the Botanical Register, and also by Sims in the Botanical Magazine. Sims wrote that the plant was "already to be found in most of the large collections about town [London]." These writers refer the plant to the Linnæan class Didynamia, but Ker also suggests that it may belong to the Campanulaceæ. This *Gloxinia speciosa* was the forerunner and leading parent of the garden gloxinias, but it turns out that the plant really belongs to Nees' genus Sinningia, founded in 1825 on a Brazilian plant which he named *S. Helleri;* but the rules of nomenclature make the tenable name to be **Sinníngia speciòsa,** Benth. & Hook. (See *Sinningia.*) All the garden gloxinias are therefore sinningias, but to gardeners they will ever be known as gloxinias; therefore, the evolution of them may be traced here.



1655. Modern gloxinia blooms.—Sinningia speciosa. (×⅓)

Gloxinia has no tubers: Sinningia has a tuberous rhizome. Gloxinia has a ring-like or annual disk about the ovary: Sinningia has 5 distinct glands.

The sinningias are either stemless or st.-bearing, with a trumpet-shape or bell-shape 5-lobed and more or less 2-lipped corolla, a 5-angled or 5-winged calyx, 4 stamens attached to the base of the corolla, and with anthers cohering at the tips in pairs, and a single style with a concave or 2-lobed stigma. The garden gloxinias belong to the subgenus Ligeria (subgenus of Sinningia), which has a short st. or trunk, and a broad-limbed bell-shape fl. Gloxinia has perhaps a half-dozen species from Mex. to Brazil and Peru; Sinningia has about 20 species, in Brazil.

1656. A good gloxinia plant.

The true gloxinias are not florists' flowers, and they are little known in cultivation. They are apparently not in the American trade. The old *G. maculata* is figured in the Garden 39:801 (p. 364), and it is probably to be found in choice collections in the Old World. It produces knotty rootstocks, which, as well as the leaves, may be used for propagation. It is also figured in B.M. 1191. *G. glabrata*, Zucc., from Mexico, is the *G. glabra*, Hort., *Achimenes gloxiniæflora*, Forkel, and *Plectopoma gloxiniflorum*, Hanst. It is a stemmy plant, bearing white flowers with yellow-spotted throat; B.M. 4430, as *G. fimbriata*, Hook. Plectopoma is now referred to Achimenes, and the plant then takes the name *Achimenes glabrata*, Fritsch. It appears not to be in the trade. Other related genera are Diastema, Dicyrta and Isoloma.

The garden gloxinias (genus *Sinningia*) are nearly stemless plants, producing several or many very showy bell-like flowers, each on a long stem. *G.* (*Sinningia*) *speciosa* originally had drooping flowers, but the result of continued breeding has produced a race with flowers nearly or quite erect (Figs. 1655, 1656). The deep bell of the gloxinia is very rich and beautiful, and the erect position is a decided gain. The flowers also have been increased in size and number, and varied in shape and markings; the leaves also have become marked with gray or white. The color of the original *Gloxinia* (*Sinningia*) *speciosa* was a nearly uniform purple. The modern races have colors in white, red, purple and all intermediate shades, some are blotched, and others are fine-spotted or sprinkled with darker shades. It is probable that the larger part of the evolution in the common greenhouse gloxinia is a direct development from the old *G. speciosa*, but hybridity may have played a part. One of the earliest recorded series of hybrids (1844) was with *Sinningia guttata*, which is a plant with an upright stem and bearing rather small spotted flowers in the axils of the leaves. (B. R. 1112.) The issue of this cross showed little effect of the *S. guttata*, except a distinct branching habit in some of the plants (B.R. 30:48). It is possible, however, that *S. guttata* has had something to do with the evolution of the spots on the present-day flower, although the original *G. speciosa* was striped and blotched in the throat. The student who wishes to trace some of the

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older forms of garden gloxinias may look up the following portraits: B.M. 1937, speciosa itself; B.M. 3206, var. albiflora; B.M. 3934, var. macrophylla variegata; B.M. 3943, var. Menziesii; F.S. 3:220, Teichleri (hybrid); F.S. 3:268; F.S. 4:311, Fyfiana (hybrid); F.S. 6:610; F.S. 10:1002; F.S. 14:1434–6; F.S. 16:1699 and 1705; F.S. 17:1768, 1772–6; F.S. 18:1846, 1878, 1885, 1918, 1919; F.S. 19:1955, double forms; F.S. 21:2164; F.S. 22:2324. I.H. 42:39, 41. Gt. 47, p. 79; Gt. 48, p. 80. Gn. 15:162; 43:392; 52, p. 268. R.H. 1846:301, Teuchlerii; R.H. 1848:201, Fyfiana; 1877:70, variabilis; R.H. 1883, p. 248. For florists' plants, see A.F. 11:7; A.G. 14:49; Gng. 6:83. There are many Latin-made names of garden gloxinias, but the plants are only forms of the *G. speciosa* type. One of the trade entries is *G. crassifolia*, a name applied to some of the best and largest-growing strains.

There are double forms of gloxinia, in which an outer but shorter corolla is formed. The forms are more curious than useful. L. H. B.

Cultivation of gloxinia.

Few flowers can surpass the large tubular blooms of gloxinia for richness and variety of coloring. The colors range through all the shades of blues and purples, pinks and crimsons, while some are pure white, and others again white with tinted edges; still others have the colors dotted on the lighter ground-color. The foliage also of gloxinias is very beautiful, being of a rich soft velvety texture. Gloxinias make a gorgeous display, therefore, when in flower and are especially valuable for the decoration of conservatories during the summer and early fall months.

Gloxinias are native of tropical America and therefore require a warm greenhouse or tropical temperature in the growing season. When first introduced into cultivation, and even for many years after, the flowers of gloxinias were all nodding, that is they hung down instead of standing upright; no one now grows the nodding-flowered kinds, the upright-flowered being so much more attractive.

Though they may be grown so as to flower at almost any season of the year, yet they are naturally summer-flowering plants, and do best when treated as such. They are propagated by seeds, or by cuttings made of leaves or stems. Seeds are preferable, unless one wishes to increase some very choice colored variety, when it is best to propagate by leaf-cuttings, using partly matured medium-sized leaves with a small portion of leaf-stalk attached (Fig. 1176, p. 929). These may be inserted in an ordinary propagating-bed, where if kept rather on the dry side, they will soon root and form tubers, when they may be potted and grown on. Seeds should be sown in a warm temperature early in February, in pans or shallow boxes containing a finely sifted mixture of peat, leaf-mold and silver sand in about equal proportions. The seedlings will begin to appear in about ten days, when great care must be exercised in watering, or they will "damp-off." In fact, success with these plants throughout the year depends largely upon the care exercised in watering. Even in their most active growth the water always should be given from the spout of a watering-can, taking care not to wet the leaves, though they like a warm, humid atmosphere during their growing season. As soon as the seedlings can be conveniently handled, they should be potted singly into thumb-pots and grown on rapidly, using in subsequent shifts a mixture of two parts leaf-mold, one part good fibrous loam and one part peat. The plants must be well shaded from sunlight and placed in a position free from draughts. The seedlings should begin to flower by the middle of August, when they should be given an abundance of air. After flowering, the leaves will begin to mature, when water should be gradually withheld. As soon as the leaves have all ripened off, the pots should be stored away in some convenient place for the winter, in a temperature of about 45°, giving just sufficient water to keep the tubers from shriveling. Toward the middle of February the tubers will show signs of starting into growth. A batch should be started at this time, choosing the tubers which appear most active, and the remainder should be held back for another month; this will give a much longer period of blossoming. The tubers should have all the old soil shaken off and be potted again in clean well-drained pots, using sizes just large enough to accommodate the tubers, the compost being the same mixture as before recommended. They should be given but little water until active root-growth commences. As soon as the pots are filled with roots, they should be shifted on at once into the pots they are intended to flower in, as frequent shifts would more or less damage their leaves, which have a tendency to cling round the sides of the pots. The first batch should come into flower in June.

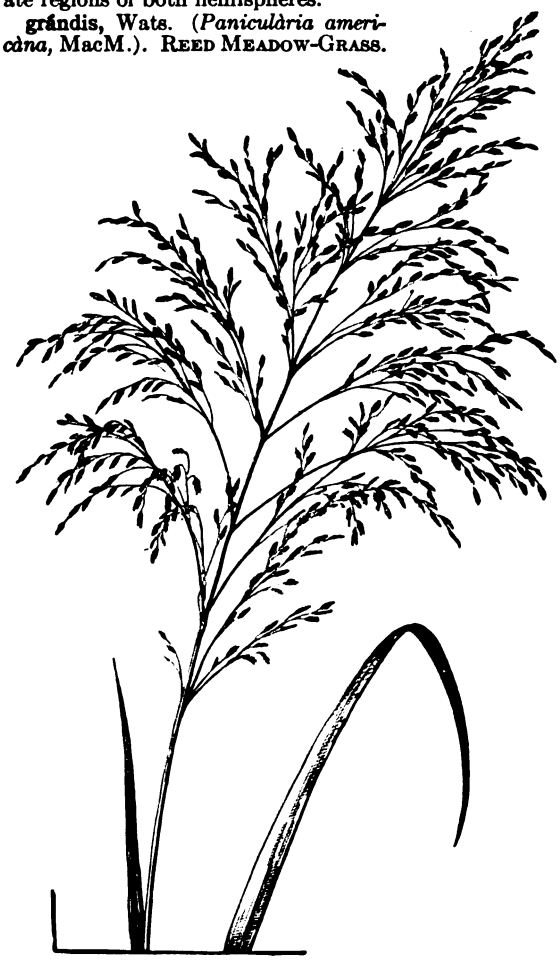
When carefully grown, gloxinias are particularly free from insect pests or fungous diseases, and the same tubers can be grown for several years.

EDWARD J. CANNING.

GLYCÈRIA (Greek, *glukeros*, sweet). *Gramineæ.* Marsh perennials with open (or rarely contracted) panicles, sometimes grown for ornament.

Spikelets few- to many-fld.; lemmas convex, firm, with a scarious margin or apex, usually obtuse, awnless, prominently 5–9-nerved.—Species about 16 in temperate regions of both hemispheres.

grándis, Wats. (*Panicularia americana*, MacM.). REED MEADOW-GRASS.



1657. Glyceria grandis. (×½)

Fig. 1657. Three to 5 ft.: lower sheaths rough and overlapping; blades 3–8 lines wide; glabrous: panicle 8–16 in. long, many-fld., open and spreading; spikelets 4–7-fld., 3 lines long. Dept. Agric., Div. Agrost. 7:286. N. U. S.

nervàta, Trin. (*Paniculària nervàta*, Kuntze). FOWL MEADOW-GRASS. One to 3 ft.: blades 1–2½ lines wide, scabrous above: panicle 4–8 in. long, open, the branches drooping; spikelets 3–7-fld., 1 line long. Ibid 287.—Widely distributed in U. S. A. S. HITCHCOCK.

GLYCÌNE (Greek for *sweet*). *Leguminòsæ*. The soybean and related plants. The glycines are allied to Dolichos, Vigna and Phaseolus: the cult. species are distinguished by small and hairy fls. in short axillary racemes: stipules very small and free from the petiole: lfts. 3, large.—Perhaps 40 species, mostly tropical, in Asia, Afr., and Austral., nearly all twining vines. In this country Glycine is known only in the soybean, **G. Sòja,** Sieb. and Zucc., which is an erect, hairy annual from Japan and China. It is also known as the soja or soya bean, coffee bean and coffee berry. It grows 2–6 ft. high, making a rank, bushy herb, and bearing axillary clusters of small hanging, hairy pods, with constrictions between the seeds. Fls. small, white or purple. The seeds are subglobose to oblong, yellow, green, brown or black, but in some varieties particolored. In China and Japan the beans are much used for human food and for the production of oil. For the latter purpose great quantities of seed have been exported in recent years from Manchuria to Eu. In this country the plant is grown for forage, its first use for this purpose dating from 1854. Since 1882, and especially since 1898, the crop has been steadily gaining in importance. The beans may be used as a substitute for coffee; and for this purpose the plant is often sold. The erect form of soybean is unknown in a wild state. It is clearly a domesticated form of **G. ussuriénsis,** Regel & Maack, which is wild in Japan, Manchuria, China, and India. For the economic merits of soybeans, see various experiment station reports; also Farmers' Bull. No. 372, U. S. Dept. of Agric. For a technical exhaustive paper see Bureau of Plant Industry, Bull. No. 197. The soybean has also been made the basis of a distinct genus under the name of Soja, Moench. Glycine was clearly used by Linnæus to refer primarily to the ground-nut, *Apios tuberosa*. Botanists who accept Glycine in that sense use Soja for the soybean and allied species. The plant named *Phaseolus max* by Linnæus is the soybean, and as the description is on a previous page to that of *Dolichos Soja*, some authors use the specific name *max* and designate the soybean as *Soja max*.

G. chinénsis = Wistaria sinensis. — *G. frutéscens* = Wistaria speciosa.—*G. sinénsis*=Wistaria. C. V. PIPER.†

GLYCÓSMIS (from the Greek for *sweet*, and *smell*). *Rutàceæ*. Thornless shrubs or small trees, grown for ornament.

Leaves persistent, alternate; lfts. 1–9, alternate or nearly opposite, dark green above, pale below, coriaceous, entire or obscurely crenulate: fls. in axillary or terminal panicles, small, white, fragrant, urceolate, 5-merous; calyx pubescent (ciliate); ovary 2–5-celled with 1 ovule in each cell; style very short, persistent; stamens 10, free, inserted in 2 series on the disk: frs. small, with a fleshy pulp in which are imbedded the large rounded seeds; cotyledons epigeous in germination; first foliage-lvs. simple, opposite.—Several species are known, occurring in India and Ceylon and extending to Austral., the Philippines, and China. Only one has as yet been intro. into cult. in this country.

pentaphýlla, DC. (*Limònia pentaphýlla*, Retz. *Toluifera cochinchinénsis*, Lour. *G. cochinchinénsis*, Pierre). Small inermous shrubs with pinnate lvs. having 1–7 lfts.: fls. urceolate, very small, white, fragrant: berry 2–3-celled with 1 or 2 brownish green rounded seeds imbedded in the fleshy pulp.—A very variable species common throughout India, Indo-China, Philippine Isls. and Malayan Archipelago. Ill. Roxbg. Pl. Coromandel, 1:60, pl. 84. Talbot, For. Fl. Bombay, p. 192, fig. 117.—This species is sometimes grown as an ornamental in greenhouses or out-of-doors in the southern states. Because of its dark green glossy lvs. and translucent pinkish berries, it is a handsome shrub for warm semi-tropical climates. WALTER T. SWINGLE.

GLYCYRRHÌZA (Greek, *sweet root*). *Leguminòsæ*. LICORICE, also spelled LIQUORICE, and LICKORICE. This genus contains the plant whose roots produce the licorice of commerce.

The genus has about a dozen widely scattered species of perennial herbs, often glandular: lvs. odd-pinnate; lfts. of indefinite number, rarely 3, entire, with minute glands or teeth: fls. blue, violet, white or yellowish, in axillary racemes or spikes, which are pedunculed or sessile.—About a dozen species in the Medit. region, Trop. Asia, W. Amer. and S. Amer., only one of which appears to be cult.

The roots of *Glycyrrhiza glabra*, of southern Europe and central Asia, are used extensively by druggists; in America by brewers and manufacturers of plug tobacco; in Turkey, Egypt and France to make cooling drinks. Our supply—more than $1,500,000 worth in 1899—is derived mainly from Spain, Portugal, Italy, Turkey and Russia (Transcaucasia), the roots from Spain and Italy being considered best, and those from Turkey poorest on account of their bitterness. The soil for licorice must be deep, mellow, moist, rich and free from stones. Plants are usually set in rows, 3 feet or more apart, and not less than 1 foot asunder. After the plants have covered the ground, they are allowed to shift for themselves for three or four years. Harvesting is primitive, the roots being exposed by the plow and pulled by hand. Large quantities of roots are thus left to produce a succeeding crop or to overrun the field as weeds. One ton to the acre is considered a fair yield; 1.6 cents a pound an average price. In America the only fields worthy the name are in California, where licorice is not considered very paying. Experiment and experience with it are, however, but little more than begun. (M. G. Kains.)

glàbra, Linn. Height 2–3 ft.: lfts. ovate, subretuse, subglutinous beneath, 4–8 pairs, with an odd one: spikes peduncled, shorter than the lvs.; fls. closely clustered, the calyx glandular pubescent: pods glabrous, 3–4-seeded. Summer and autumn.—Seeds in pods are listed by a few dealers with miscellaneous agricultural seeds. WILHELM MILLER.

GLYPTOSTRÒBUS (*engraved* or *marked cone*). *Pinàceæ*. One or 2 species of trees of swamps and low grounds in China, separated by some authors from Taxodium, but here included in that genus. The basis of separation from Taxodium lies mostly in the fact that the cone-scales are deciduous, whereas in Taxodium proper they are persistent; the mature cones are obovoid with a long contracted base, the seeds scarcely angled and stipitate or narrowed at the base into a wing. *G. heterophýllus*, Endl. (*Taxòdium heterophýllum*, Brongn., which see), is a shrub to 10 ft. high, with lower branches pendulous: lvs. long, linear, 3-rowed or scattered, on the fruiting branches short and rather obtuse and spirally imbricate: cones ovoid, ¾in. long: tender, and little cult.

GMELÌNA (after one of five distinguished German botanists named Gmelin). *Verbenàceæ*. Trees and shrubs, bearing yellow or brownish irregular flowers sometimes nearly 2 inches across. A very few plants may be cultivated in European warmhouses, and in America only in southern Florida and southern California outdoors.

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Spiny or not: shoots tomentose: lvs. opposite, entire, toothed or lobed: fls. in panicled cymes or racemes, tomentose at least while young; calyx bell-shaped, shortly 5-toothed or entire; corolla-tube slender below; limb oblique, 5- or 4-lobed; stamens 4, didynamous, nearly exserted: fr. a succulent drupe.—Eight or 10 species from E. Asia and N. Austral. The genus produces a fancy timber similar to teak, which is a product of the same order. Vitex and Clerodendron are better known congeners.

A. *Plant not climbing.*

B. *Lvs. becoming 9 in. long, 6 in. wide.*

arbòrea, Roxbg. (*G. Rheèdii*, Hook.). Unarmed tree, sometimes attaining 60 ft., deciduous, flowering with the young lvs.: lvs. cordate-ovate, entire: panicles often 1 ft. long, terminal. India, Malaya. B.M. 4395.—Cult. apparently only in S. Calif. by Franceschi, who keeps *G. Rheedii* separate.

BB. *Lvs. ½–1½ in. long.*

asiática, Linn. (*G. parviflòra*, Pers., a typographical error for *G. parvifòlia*, Roxbg.). Shrubby, sometimes spinescent: lvs. ovate or obovate, entire or lobed: fls. in racemose clusters, the corolla about 1½ in. across. India, Ceylon.

AA. *Plant scandent.*

Hýstrix, Kurz. A large spiny scandent shrub: lvs. 3 x 1½ in., entire, glaucous beneath: fls. in dense terminal cymes, the bracts very large and nervose, colored; corolla about 2 in. across, yellow, but not hairy on the outside as in *G. asiatica*. E. Indies.—A sprawling plant with the habit of bougainvillea.

N. TAYLOR.†

GNAPHÀLIUM. See *Leontopodium* and *Helichrysum*. There are various native gnaphaliums, but they are not in cultivation. *G. lanatum* of gardeners is *Helichrysum petiolatum*.

GNÌDIA (*Gnidus*, a place in Crete). *Thymelæàceæ*. Trees, shrubs or subshrubs, of about 100 species in Trop. and S. Afr. and E. India. Some of them have been grown abroad as greenhouse evergreen woody often heath-like subjects: lvs. mostly small: fls. white, yellow, red or violet, mostly in heads on the ends of the branches; perianth-tube cylindrical, at length detaching above the ovary, the lobes 4 and spreading, with scales in the throat alternating with the lobes; stamens 8; ovary sessile, 1-celled: fr. small and dry, included in the persistent base of the perianth. *G. polystàchya*, Berg. Handsome shrub, to 6 ft., with many graceful pubescent branches: lvs. crowded-imbricate: fls. small, yellow, in terminal heads. S. Afr. B.M. 8001. G.C. III. 41:294. *G. tomentòsa*, Linn. Three to 4 ft.: lvs. ovate or ovate-lanceolate, decussate and sometimes reflexed: fls. yellow, fascicled with the lvs. at the ends of the branches, the tube slender and silky. S. Afr. B.M. 2761.

L. H. B.

GOAT'S-BEARD is usually *Aruncus sylvester* (*Spiræa Aruncus*); also the genus Tragopogon.

GODÈTIA (C. H. Godet, Swiss botanist). *Onagràceæ*. Mostly erect annuals with very showy flowers in leafy racemes or spikes.

Calyx-tube obconic or funnelform; petals rose, lilac-purple or white, often marked with a large deep crimson or purple spot; stamens 8; ovary 4-celled, inferior: fr. a many-seeded caps.—Twenty or more species in the western parts of S. and N. Amer., especially Calif.

Seed may be surface-sown in the late fall in order to be covered by the rains which follow, or in February lightly covered in sunny or in half-shady places. *G. amœna* is very popular and furnishes an abundance of bloom in early summer when many late spring annuals have succumbed to advancing heat. In the wild garden the species come again freely but have a tendency to move to new ground after the second year.

A. *Plants tall, slender: fls. loosely spicate-paniculate.*

amœna, Lilja. FAREWELL-TO-SPRING. Fig. 1658. Slender, branching, 1–2 ft. high: lvs. linear to lanceolate, ½–2½ in. long, often with smaller ones fascicled in the axils: buds erect: calyx-lobes united and turned to one side on expansion of the fl.; corolla lilac-crimson or red-pink, satiny, 1–2 in. broad: caps. teretish, sessile or very shortly pedicelled. Cult. also in European gardens (since 1818). Exhibits considerable variability, especially in the size, and color-scheme of the fls. *G. rubicúnda*, Lindl. (B.R. 1856), is the lilac-crimson form. *G. vinòsa*, Lindl. (B.R. 1880), is a white-fld. state. *G. Schwáminii* (Gn. 70:203), a double-fld. pink

1658. Godetia amœna (G. rubicunda splendens of the trade). (×½)

form. *Œnothèra Lindleyi*, Douglas (B.M. 2832), has the crimson petals with a large central blotch of deeper color. *Œnothèra róseo-álba*, Bernh. (Reichenbach, Icon. Bot. Exot., pls. 47 and 150), is a prolific-flowering form.

Bóttæ, Spach. Similar to *G. amœna:* buds nodding: petals pink or light crimson; stigmas united at base to form a cup-like apex to the style: caps. long-stalked, usually with flat sides. S. Calif. near the coast.

AA. *Plants low: fls. in a short spike or cluster of spikelets.*

grandiflòra, Lindl. (*Œnothèra Whitneyi*, Gray). Fig. 1659. Stout, simple and dwarfish, 4–12 in. high: lvs. oblong, tapering to base and apex: buds large, 1–2 in. long; corolla 3–5 in. across, rose-red with a deeper blush or blotch in center, varying into pure white (Duchess of Albany), dark crimson (Lady Albemarle), or bright carmine (Lady Satin Rose): caps. sessile, 4-

sided, 8-ribbed. B.M. 5867. J.F. 318.—A highly prized species.

G. decúmbens, Douglas. Sts. ascending, strongly flattened, whitish pubescent: ovary white-woolly. B.M. 2889. B.R. 1221. —Not certainly known in a wild state. Seed originally from Ore. Differs little technically from G. quadrivulnera or its forms but is quite unchanged in its characters after 75 years or more of cult. in European gardens. It is an excellent illustration of the manner in which many strains of the smaller-fld. godetias maintain their slight but distinctive characters, although subject for many years to the varying conditions of garden cult.—*G. magellánica*, Burbank, a diffuse free-flowering species with lavender fls. the size of G. amœna, has been recently intro. from Patagonia by Luther Burbank.—*G. quadrivúlnera*, Spach. Erect, slender, pubescent: lvs. obovate to linear or the uppermost lanceolate and half-conduplicate: petals lilac or pale crimson, usually with a spot at apex, 4–6 lines long: caps. sessile, 4-sided, lightly 8-ribbed. B.R. 1119. Occasionally cult., but probably not in the trade.—*G. Romanzòvii*, Spach, from the "northwest coast," not now known in a wild state, has been cult. in Eu. nearly a century. Very leafy with young parts white-pubescent: lvs. oblong-oblanceolate. B.R. 562.

W. L. JEPSON.

1659. Godetia grandiflora, Œnothera Whitneyi of the trade. (×⅓)

GOÈTHEA (Goethe, the great German poet, who was also a botanist). *Malvàceæ*. Two Brazilian evergreen shrubs, seldom grown in hothouses. Lvs. alternate, simple, entire or nearly so: fls. showy, in cymes from the leafless sts. or sometimes solitary in the axils, subtended by large cordate red showy calyx-like bracts; calyx 5-toothed, included within the bracts; petals short; stamens united in a column, which is 5-toothed below the apex; ovary 5-celled, each 1-ovuled. *G. strictiflòra*, Hook. (*G. cauliflòra*, Hort.), is a small shrub or bush with large ovate lvs. sinuate on upper half, and aggregated fls. in yellowish white red-tinged bracts; petals small, obcordate, veiny; calyx whitish or greenish, the lobes ovate-acuminate; fls. on short-peduncles that are aggregated in the axils along the st. B.M. 4677. J.F. 4:365. *G. multiflora*, Nichols., and *G. semperflorens*, Nees & Mart., belong in Pavonia. L. H. B.

GOLDEN CHAIN: *Laburnum vulgare.*

GOLDEN FEATHER: *Chrysanthemum Parthenium.*

GOLDENROD: *Solidago.*

GOLDEN SEAL: *Hydrastis.*

GOLDFÙSSIA: *Strobilanthes.*

GOLD THREAD: *Coptis trifolia.*

GOMBO, Gumbo, or Okra: *Hibiscus esculentus.*

GOMÈSA (named in honor of Bernardinus Antonius Gomes). *Orchidàceæ*. Stove epiphytes.

Pseudobulbs 1- or 2-lvd.: racemes often many-fld., lateral; sepals free and spreading, or the lateral approximate or connate; petals equaling or wider than dorsal sepal; lip affixed to base of column, continuous, spurless, the lateral lobes small; pollinia 2.—About 5 or 6 species, natives of Brazil.

planifòlia, Klotzsch (*Odontoglóssum planifòlium*, Reichb.). Pseudobulbs ovoid, 1½–2 in. long, 2-lvd.: lvs. 4–5 in. long: racemes exceeding the lvs.; fls. fragrant, light greenish yellow; sepals and petals oblong, acute, the lateral sepals united nearly to the apex; lip shorter than petals, broadly oblong, acute, reflexed. B.M. 3504 (as Rodriguezia). G.W. 14, p. 517.

G. Binòtii, Hort. Racemes 15–30-fld.; fls. small, orange, with a white column. Brazil.—*G. Glaziòvii*, Cogn. Climbing: st. elongated: pseudobulbs 2–4 in. apart: fls. light green. Brazil.

GEORGE V. NASH.

GÓMPHIA: *Ouratea.*

GOMPHOCÁRPUS (*club-fruit*). *Asclepiadàceæ*. Perennial herbs, or subshrubs, of more than 100 species, mostly of the Old World, of which one has been mentioned recently in horticultural literature abroad; very closely allied to Asclepias, being distinguished mostly by the absence of crests or appendages on the hoods. *G. téxtilis*, Naudin, a warm-country species but nativity unknown, is a semi-woody plant 3 ft. high with slender branches: lvs. opposite, linear-lanceolate: fls. white, in terminal clusters, the lobes of the crown violet: fr. large, obliquely oval in outline, bladdery, pale green, long-hairy, to 4 in. long. R.H. 1902, p. 35. —Described as a showy and worthy plant for the border.

L. H. B.

GOMPHOLÒBIUM (name refers to club-shaped pod). *Leguminòsæ*. Two dozen Australian yellow- or red-fld. shrubs, rarely cult. Lvs. simple or compound, the lfts. mostly narrow: fls. papilionaceous, solitary, few or in short racemes; standard orbicular or reniform, exceeding the other petals; wings falcate-oblong; keel mostly broader than the wings, obtuse; stamens free: pod very wide or nearly globular, inflated, bearing small seeds. They are said to be excellent greenhouse shrubs; prop. by cuttings of young shoots. *G. polymórphum*, R. Br. Glabrous shrub or undershrub, variable in foliage and habit: lfts. 3, but sometimes 5 or 7 or 9, digitate, mostly linear, to 1 in. long: fls. orange-yellow to bright crimson: pod much inflated, ovoid-globular. B.M. 1533, 4179. H.U. 1, p. 166. B.R. 1574 (as *G. venulosum*, Lindl.). B.R. 1615 (as *G. tenue*, Lindl.). B.R. 25:43 (as *G. versicolor*, Lindl.).

L. H. B.

GOMPHRÈNA (name suggested by *Gromphræna*, Pliny's name for some amaranth, supposed to be derived from *grapho*, to write or paint; alluding to the highly colored or "painted" foliage). *Amarantàceæ*. Herbaceous plants grown as "everlastings."

Herbs erect or prostrate, pubescent to villous, with or without a leafy involucre: fls. short or long, white or colored: bracts short or long, concave, and keeled, winged or crested on the back.—About 70 species, mostly in the warmer parts of Amer. and Austral., but the globe amaranth is widely dispersed throughout the tropics. For cult., see *Annuals* and *Everlastings*.

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This genus includes the globe amaranth, a common everlasting flower of easy culture. It is also known as bachelor's button, though two other utterly distinct plants (*Centaurea Cyanus* and *Ranunculus acris*) have the same popular name. The flower-heads are an inch or less in diameter, globose, of many colors, and chiefly remarkable for the showy bracts, which hide the true flowers. In a family remarkable for brilliant foliage this genus seems to be the only one valued for everlastings. Nearly all the other everlasting flowers of importance belong to the Compositæ.

globòsa, Linn. GLOBE AMARANTH. BACHELOR'S BUTTON. Height 18 in. or less: lvs. elliptic to obovate, the largest 4 in. long, 1½ in. wide, tapering to a petiole. July. B.M. 2815. R.H. 1890, p. 522. F.R. 1:333. The following names of horticultural varieties indicate the range of color: vars. **álba, aûrea, cárnea, nàna compácta** (=*alba*) **purpûrea, striàta, violàcea.** Dwarf and compact forms are likely to be associated with any color. There is a narrow-lvd. form of this species which Voss calls **G. Haageàna,** Klotzsch (*G. aurantiaca,* Hort. *G. coccinea,* Decne.), which has lanceolate lvs., often 6 times as long as broad. The lvs. are rarely ½ in. wide. R.H. 1854:161. All are easily grown annuals.

G. gnaphalioides, Vahl=Pfaffia. WILHELM MILLER.

GONGÒRA (after Don Antonio Caballero y Gongora, Bishop of Cordova). Includes *Acropèra.* *Orchidàceæ,* tribe *Vándeæ,* subtribe *Cyrtopòdieæ.* A small group of plants with curious spotted flowers, not common in cultivation, and of little value except for collections.

Distinguished from the other members of the subtribe by being epiphytic, having the dorsal sepal adnate to the column, and by its many-fld. raceme: dorsal sepal erect, spreading, thus appearing to spring from the base of the column; lateral sepals spreading or reflexed from the base of the column, wider; petals small, adnate to the base of the column; labellum continuous with the column, narrow and fleshy, with 2 thick lateral horned or aristulate lobes, and a central one which is saccate or even folded, forming a vertical plate; column erect or ascending, not winged: pseudobulbs sulcate, sheathed, bearing 1 or 2 large, plicate lvs.: fls. borne in a long, loose, pendent raceme arising from the base of the pseudobulbs.—Over 20 species from Brazil to Mex.

Gongoras are extremely free-flowering, and grow easily in a mixture of sphagnum and peat, with a little charcoal added for drainage. During the growing season they require plenty of water, and brisk heat. In the winter they require little water, but should be kept in a moist atmosphere in a cool, shaded house. They grow well with cattleyas, or in a temperature of 60° in winter and 80° in summer. Some growers prefer to use fine fern root packed tightly and for a top finish a little fine moss found in damp meadows, instead of sphagnum, which in this climate is quick to decay. (Wm. Mathews.)

A. *Lateral sepals ovate or oblong, truncate.*

truncàta, Lindl. Pseudobulbs deeply furcate: lateral sepals rotund, oblong, truncate, the upper one ovate, keeled; petals minute, ovate; sepals and petals pale straw-color, spotted with purple; base of labellum compressed in the middle, 2-horned; apex ovate, canaliculate. B.R. 31:56.

AA. *Lateral sepals broad, ovate, pointed.*

B. *Fls. light sepia-brown; ovary much incurved.*

galeàta, Reichb. f. (*Maxillària galeàta,* Lindl. *Acropèra Lóddigesii,* Lindl.). Fig. 1660. Pseudobulbs ovate-conical, clothed with membranous scales: lvs. broadly lanceolate, 6 in. long: racemes drooping, 6–8 in. long, with 6–12 pale sepia-brown fls.; dorsal sepal galeate; petals small, oblong-truncate; labellum 3-lobed; lateral lobes inflexed, middle one saccate. The plants bear several short, rather large-fld. racemes. Aug. Mex. B.M. 3563. L.B.C. 17:1645.

BB. *Fls. yellow; ovary somewhat incurved.*

armeniaca, Reichb. f. (*Acropèra armeniaca,* Lindl.). Pseudobulbs ovate, sulcate, 2-lvd.: raceme loose, bearing many yellow fls.; sepals ovate, rounded, apiculate, the lateral ones oblique; petals one-half as long as the column; labellum fleshy; apex ovate, plane, acuminate, base tuberculate, crested. B.M. 5501.

AAA. *Lateral sepals lanceolate to ovate-lanceolate.*

B. *Fls. chocolate-brown, spotted.*

atropurpûrea, Hook. Pseudobulbs oblong-cylindrical, deeply sulcate, 2-lvd.: lvs. about 1 ft. long, lanceolate, subplicate: racemes numerous, 2 ft. long, bearing many chocolate-colored, spotted fls. about 2 in. diam.; margins of the sepals revolute; petals small, twisted at the apex; labellum 4-horned at the base; apex folded so as to form a vertical triangular plate. Trinidad. B.M. 3220.—This species is the most common in cult. It is nearly always in flower during the summer.

1660. Gongora galeata.

BB. *Fls. yellow, spotted.*

quinquenérvis, Ruiz & Pav. (*G. maculàta,* Lindl.). Pseudobulbs ovate-oblong, deeply furrowed, 2-lvd.: lvs. broadly lanceolate, 5-plaited: racemes many, 2 ft. long, with numerous yellow fls. spotted with dark red; lateral sepals reflexed, meeting in the back; petals small, linear-oblong, from the middle of the column; lip 4-horned at base; apex folded, tapering to a setaceous point. May–Aug. B.M. 3687. B.R. 1616.—A curious plant, much resembling *G. atropurpurea* except in color and form of fls.

BBB. *Fls. dull red-purple spotted, with a yellow labellum.*

tricolor, Reichb. f. (*G. maculàta* var. *tricolor,* Lindl.). Pseudobulbs ovoid, 2½ in. long, deeply furrowed: lvs. ovate-oblong, acuminate, about 5-ribbed, 6 in. long: raceme slender, pendulous, lax-fld., 6–10 in. long; pedicels with ovary 1½–2 in. long, speckled like the rachis; fls. about 2 in. long; dorsal sepals lanceolate, with revolute margins, tip recurved, lateral sepals ovate-lanceolate, with revolute margins, dull red-purple, with a pale, stout midrib; free portion of the petal spreading, upcurved, lanceolate, speckled; labellum golden yellow, base cuneiform saccate, truncate in front, with an awn on each side, apical part broadly funnel-shaped, with a spurlike, slender, speckled tip, gibbous behind; column slender, speckled. B.M. 7530. B.R. 33:69.

G. Beyrodtiàna, Schlecht. Allied to G. truncata. Infl. pendulous, about 16 in. long; fls. pale yellow, spotted with purple. Colombia.—*G. bufònia,* Lindl. Resembles G. atropurpurea in habit, lvs. and pseudobulbs: fls. yellowish white, thickly spotted with dull

purple. Brasil. B.R. 27:2. G.W. 13, p. 110.—*G. fuscàta*, Hort. (Acropera fuscata and luteola, Hort.), has been cult. for many years, but no description is available.—*G. Tracydna*, Rolfe. Sepals and petals greenish yellow, marked with brown; lip ivory-white. Peru.

H. HASSELBRING.

GONIÒMA (Greek, *gonia*, angle, corner; the corona cornered near the top). *Apocynàceæ*. Shrub, introduced for the warmer parts of the country.

A monotypic genus containing a S. African glabrous plant with coriaceous lvs. and terminal corymbose fls.: calyx small, with 5 more or less herbaceous sepals; corolla with 5 lobes, overlapping to the left; stamens inserted at the middle of the corolla-tube. Gonioma differs from Tabernæmontana in having the ovules arranged in 2 series instead of an indefinite number of series.

Kamássi, Mey. (*Tabernæmontàna Camássi*, Regel). Height 16–20 ft.: lvs. opposite or the upper ones in 3's, oblong-lanceolate, entire, leathery, 4–6 lines wide: corymbs small, terminal, 8–10-fld.; fls. salver-shaped, yellowish, 3 lines long; tube a little wider at the middle and angled, constricted at top, pilose within from the middle to the top; lobes a third as long as the tube, ovate, cordate, twisted to the right in the bud; style 2-cut: fr. 1–2½ lines long.—Yields the hard yellow Kamassi wood of S. Afr.

N. TAYLOR.†

GONIOPHLÈBIUM. A subgenus of Polypodium, (or perhaps a distinct genus), with a special type of anastomosing veins. For *G. subauriculatum* and *G. vacciniæfolium*, see *Polypodium*.

GONIÓPTERIS (Greek, *angled fern*). *Polypodiàceæ*. A generic name for a group of tropical ferns belonging with Dryopteris, with naked rounded sori and the lower veinlets of contiguous segments or lobes united. Has been placed under Polypodium. For *G. crenata*, see *Dryopteris crenata*.

GONIOSCÝPHA (name refers to the *angled perianth*). *Liliàceæ*. One species, *G. eucomoìdes*, Baker, an odd nearly stemless plant from the E. Himalayas, producing 1 thick dense short-peduncled spike 3–5 in. long, of small lurid green fls.: lvs. few in a rosette, 10–15 in. long, 5–6 in. broad, elliptic or elliptic-oblong, several-nerved; petiole 3–4 in. long, broad: perianth open, somewhat fleshy; anthers 6, sessile; stigma somewhat 3-lobed: fr. a 1-seeded globose-ellipsoid dark brown berry, becoming dry. B.M. 8078. G.C. III. 20:748. G.W. 12:750.—Blooms in late autumn; produces a short fleshy rootstock.

L. H. B.

GONÓLOBUS (name refers to the *angled pod* of one of the original species). *Asclepiadàceæ*. Mostly trailing or climbing plants, herbaceous or woody, of Amer., chiefly tropical: lvs. opposite and mostly cordate: fls. dull or dark-colored, of medium or large size, in fascicles or umbel-like cymes; corolla rotate to campanulate, 5-lobed; crown ring-like or cup-like, entire, lobed or divided; anthers short and borne under the disk of the stigma or on the margin of it; pollinia nearly or quite horizontal; stigma flat-topped.—Seventy-five or more species, only one of which seems to be in horticultural lists. **G. edùlis**, Hemsl., of Guatemala and Costa Rica, is a more or less rusty-hairy twining shrub, with ovate-oblong deeply cordate lvs., and 3–5-fld. short peduncles: corolla of medium size, white, densely bearded inside; crown short, with 5 interior longitudinal lamellæ: follicles the size of a swan's egg, edible.—It is said to be hardy at Santa Barbara and to bloom profusely but to set no fr. It is the guayote of the natives of Costa Rica.

G. Cundurdngo, Triana=Marsdenia.—*G. Martidnus*, Hook., is properly Fischeria Martiana, Decne. A handsome stove twiner with pretty fls. in early summer: lvs. oblong-ovate, hairy, acuminate: fls. white with a green ring at base and a red hairy calyx. Brazil. B.M. 4472. J.F. 1:33.

L. H. B.

GOOBER is a commoner name in the South than "peanut," which is the universal name in the North. For culture, see *Peanut;* for botany, see *Arachis*.

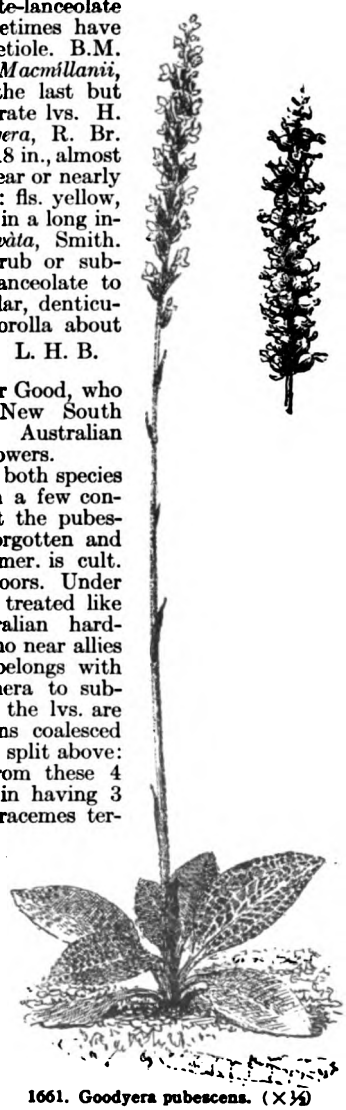
GOODÈNIA (Bishop Samuel Goodenough, England, 1743–1827, who wrote on Carex). *Goodeniàceæ* (sometimes written *Goodenoviæ*). The family Goodeniaceæ is allied to the Campanulaceæ, differing in never having milky juice, the style surrounded by an indusium or cup-shaped or two-lipped expansion, the cells of the ovary mostly more in number, and other technical characters. There are a dozen genera of herbs and shrubs and probably 300 species, mostly Australian. Probably none of them is in regular cultivation, although Goodenia and Scævola are sometimes mentioned in horticultural literature.

About 100 species of Goodenia occur in Australia: calyx-tube adnate to the ovary, the lobes free or adnate at the base; style undivided: caps. with 2 or rarely 4 valves: herbs, subshrubs, or shrubs, with yellow, purplish or blue fls. The species most likely to be met with in horticultural literature are: *G. grandiflòra*, Sims. Erect herb, with large yellow fls. more or less streaked purple, linear calyx-lobes, and broadly ovate or ovate-lanceolate toothed lvs. that sometimes have small lobes along the petiole. B.M. 890. B.R. 31:29. *G. Macmillanii*, F. Muell., very like the last but with purple fls. and lyrate lvs. H. F.II. 4:240. *G. stelligera*, R. Br. Perennial herb: st. 12–18 in., almost leafless: radical lvs. linear or nearly so, entire, 3–6 in. long: fls. yellow, nearly or quite sessile, in a long interrupted spike. *G. ovàta*, Smith. Glabrous or viscid shrub or subshrub, to 4 ft.: lvs. lanceolate to ovate or nearly orbicular, denticulate: fls. yellow, the corolla about ½in. long.

L. H. B.

GOÒDIA (after Peter Good, who found the plant in New South Wales). *Leguminòsæ*. Australian shrubs, with pea-like flowers.

There are 2 goodias; both species have long been cult. in a few conservatories abroad, but the pubescent species is now forgotten and the glabrous one, in Amer. is cult. chiefly in S. Calif. outdoors. Under glass these shrubs are treated like Cape heaths or Australian hard-wooded plants. It has no near allies of garden value. It belongs with 4 other Australian genera to subtribe Bossiæa, in which the lvs. are mostly simple: stamens coalesced into a sheath, which is split above: seeds strophiolate. From these 4 genera Goodia differs in having 3 pinnate lfts. and its racemes terminal or opposite the lvs. instead of axillary. A. Schultheis writes that goodias are occasionally seen in florists' windows in America. Wm. Watson, of Kew, says the flowers are very fragrant, and remain on the plant a long time. He adds (G.F. 2:244): "Probably this plant, if taken



1661. Goodyera pubescens. (×½)

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in hand by the florists, would prove quite as useful for spring flowering as the popular *Cytisus racemosus.*"

lotifòlia, Salisb. Often misspelled "latifolia," but the name means "lotus-leaved." A tall much-branched glabrous shrub: lfts. ovate or obovate, very blunt, about ¾in. long: racemes loose, many-fld.; the fls. yellow with purple markings near the base. B.M. 958. J.H. III. 29:484. H.F. II. 6:358.—Likely to be confused with *Argyrolobium Andrewsianum,* belonging to the Crotalaria subtribe, in which the seeds are not strophiolate. In Argyrolobium the 3 lfts. are digitate and the stipules, bracts and bractlets small but persistent. *A. Andrewsianum* has sparsely silky lvs. In Goodia the stipules, bracts and bractlets are very evanescent.

WILHELM MILLER.
N. TAYLOR.†

GOODYÈRA (after John Goodyer, British botanist, who helped Johnson in his edition of Gerarde's Herbal). *Orchidàceæ,* tribe *Polychóndreæ.* Dwarf terrestrial orchids of minor importance which are cultivated chiefly for their variegated foliage.

Leaves radical, usually reticulately veined: fls. in dense or loose spikes; labellum saccate; anther on the back of the column.—About 25 species. They have scapes 8–18 in. high at most. Difficult to grow; require shade. Includes the rattlesnake plantain.

A. *Plants hardy natives.*

B. *Labellum strongly inflated, with a short tip.*

pubéscens, R. Br. RATTLESNAKE PLANTAIN. Fig. 1661. Lvs. ovate, deep green; veins netted, white: scape stout; spike dense, ovate in outline before anthesis; fls. globular, whitish; beak of stigma short, obscure. Aug. Newfoundland to Fla., west to Mich. and Minn. L.B.C. 1:1. B.B. 1:474. Mn. 2:54. F.S. 15:1555. A.G. 12:281; 13:520. C.L.A. 4:108. Gn.M. 4:15.—Should be grown in ordinary loam mixed with pine needles and dry pine twigs. Not well suited for greenhouse cult.

1662. Goodyera repens var. ophioides. Spike denser than common. (×½)

BB. *Labellum saccate, with an elongated tip.*

C. *Beak of the stigma shorter than its body.*

rèpens, R. Br. Lvs. ovate to oblong-lanceolate; veins dark: spike 1-sided; labellum with a recurved tip. L.B.C. 20:1987. Eu. Var. **ophioides,** Fern. (Fig. 1662), is the American form of this species, with very broadly marked lvs.

CC. *Beak as long as or longer than the stigma.*

tesselàta, Lodd. (*G. pubéscens* var. *mìnor*). Lvs. broadly ovate to oblong-lanceolate; venation exceedingly variable: scape slender; spike loose; fls. white; labellum less saccate than in *G. repens;* tip straight. N. U. S. and Canada. B.M. 2540. L.B.C. 10:952.—Confused by tradesmen with the next. Should be planted out in a rockery in shade, the roots being firmly placed among dead pine needles and loam.

BBB. *Labellum scarcely saccate, margin involute.*

Ménziesii, Lindl. Plant rather large, the st. sometimes 18 in. high, being taller than *G. tesselata:* lvs. ovate-lanceolate, dark green; veins netted: spike somewhat 1-sided, rather densely fld. W. U. S. to N. New England.—Advertised by Dutch dealers.

AA. *Plants tender exotics, cult. under glass.*

B. *Lvs. with a whitish midvein.*

velùtina, Maxim. Fls. whitish, tinged rose: lvs. ovate, velvety, purplish green, with white rib. Japan. F.S. 17:1779.

BB. *Lvs. with white, netted veins.*

Schlechtendaliàna, Reichb. f. (*G. japónica,* Blume). In general appearance like *G. tesselata.* Lvs. ovate: spike loose; fls. white. Japan.

G. Dawsoniàna and *G. discolor.* See Hæmaria.—*G. nùda,* Thouars. Lvs. variegated: fls. whitish, with petals and midveins of sepals light brown. Mascarene Isls.—*G. quercícola.* See Physurus.

By some botanists, the name Goodyera is given up. The species referred to Goodyera are then by some authors placed in Peramium; by others the old application of the name Epipactis is used, and in that case what we have been calling Epipactis goes in Serapias. Following this latter disposition, the characterization of Epipactis is the same as the characterization given here for Goodyera, the name Epipactis merely supplanting Goodyera.—Under Epipactis, the above goodyeras take names as follows: *E. Willdenovii,* House (Goodyera pubescens, R. Br., Peramium pubescens, MacM., Epipactis pubescens, A. A. Eaton, not Pursh). *E. repens,* Crantz (Goodyera repens, R. Br.) *E. tesselata,* A. A. Eaton (Goodyera tesselata, Lodd.). *E. decipiens,* Ames (Goodyera Menziesii, Lindl.). *E. velutina,* A. A. Eaton. *E. Schlechtendaliana,* A. A. Eaton.—Under Serapias, the following synonyny would occur: *SERAPIAS,* Linn. Sp. Pl. 949, 1753. *Helleborine,* (Tourn.) J. Hill., Brit. Herbal 477, 1756. *Epipactis,* Zinn, Cat. Pl. Hort. Goett. 85, 1757. Adans. Fam. 2:70. 1763. *Amesia,* Nelson & MacBride. Bot. Gaz. 56:472. 1913. Species: *Serapias Helleborine,* Linn.; *Serapias atrorubens,* Hoffm. *Serapias gigantea,* A. A. Eaton (=Epipactis Royleana, Lindl.), and several others.—If Peramium is used for Goodyera, the synonymy becomes: *PERAMIUM,* Salisb. Trans. Hort. Soc. 1:301. 1812. *Epipactis,* (Haller) Boehm. in Ludw. Definit. Gen. Pl. 1760. Not Zinn 1757. *Goodyera,* R. Br. in Ait. Hort. Kew, ed. 2, 5:197, 1813. Species: *Peramium pubescens,* MacM.; *Peramium decipiens,* Piper (=Goodyera Menziesii, Lindl.); *Peramium tesselatum,* Heller; *Peramium ophioides,* Rydberg (=Goodyera repens var. ophioides Fernald).

OAKES AMES.
L. H. B.†

GOOSEBERRY. A bush-fruit, grown for its large berries, which are mostly consumed green in cookery.

The gooseberry has received comparatively little attention in America, although in northern Europe, and especially in the British Isles, it has long been a prime favorite, and a great improvement has taken place in its size there during the last 200 or 300 years. When it was first cultivated in Europe—probably in the sixteenth century—the wild fruit, if it was like what it is now, would be only about ½ inch in diameter and less than one quarter of an ounce each in weight. The largest gooseberries which have been produced in recent years average several times this size, the largest one of which there is a record weighing two ounces, although there are doubtless larger specimens produced. The English and European gooseberries are derived from a species native of northern Europe, *Ribes Grossularia* (Figs. 1663, 1664). The varieties of *Ribes Grossularia* do not succeed well in America as a general rule, although in some places they do well. The chief obstacle to their successful culture is the gooseberry mildew, which it has been found very difficult to control.

As late as 1846 no cultivated varieties of American species of gooseberries were mentioned by writers, an early reference, according to Bailey, being in 1849 in the "Northern Fruit Culturist," by Goodrich, where the author writes: "We have it from good authority that native sorts have been discovered both in New Hampshire and Vermont well adapted to garden culture." In 1847 the Houghton's Seedling was exhibited at a meeting of the Massachusetts Horticultural Society, this being the first improved form of the native gooseberry of which there is a record. This variety was originated or found by Abel Houghton, Jr., Lynn, Massachusetts. It is probably a seedling of the native species, *Ribes hirtellum* (Figs. 1665, 1666, 1667). The first improvement on the Houghton was the Downing (Fig.

1668), a seedling of the Houghton, which was originated by Charles Downing, Newburgh, New York, and first brought into notice in 1853. It is thought by some authorities to have been a hybrid between Houghton and *Ribes Grossularia*, the European species. The Downing is still more largely planted in America than any other variety of gooseberry. This is doubtless largely due to the fact that comparatively little has been done toward improving the gooseberry in America during the past fifty years. The most work seems to have been done by William Saunders, late Director of the Dominion Experimental Farms, the originator of the Pearl, Josselyn (Red Jacket), and many other seedlings and crosses not yet on the market. There is a good field for work in improving the native gooseberries, as there is no apparent reason why the size should not be equal to the best English varieties. The quality of the American varieties is considered by some to be better than the average English gooseberry, but the flavor is not nearly so good as the best of the English sorts.

1663. Ribes Grossularia in bloom. (Natural size)

1664. Leaves of Ribes Grossularia. (Natural size)

As the gooseberry is found growing wild almost or quite to the Arctic circle, its culture will no doubt be extended very far north. The most useful native species is the smooth gooseberry, *Ribes hirtellum*, which is found wild from the Atlantic to the Pacific. Next in importance is the prickly gooseberry, *Ribes Cynosbati*, which has not so wide a range. Both of these gooseberries are of good quality. An interesting hybrid gooseberry was originated by Saunders by crossing *Ribes Cynosbati*, with Warrington, a cultivated English variety. The size of the fruit was increased very much, but the gooseberry although good in quality remained prickly. If greater hardiness is desired it may be got in *Ribes lacustre*, which grows almost or quite to the Arctic circle. In its present state it is not nearly so useful as the other two species, the fruit being smaller and inferior in quality. There are other native species, such as *Ribes Lobbii*, *R. divaricatum*, and *R. rotundifolium*, which may also play their part in the future improvement of the native gooseberry.

There is a steady though limited demand for gooseberries in America, but the gooseberry has never been generally popular on this continent. In England, gooseberries are used in great quantities for eating out of hand and for jam; in America few are used raw, most of the fruit being picked green and put into pies, or used as jam or canned. Those who are successful in growing the English varieties in America are usually enthusiastic in their praise as a fruit for eating raw.

Propagation.

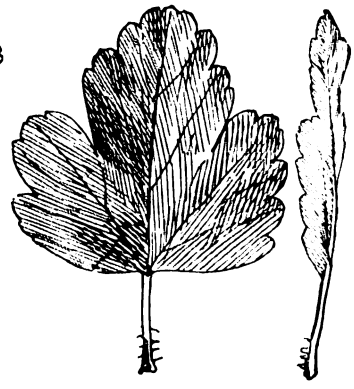
Gooseberries may be propagated either from cuttings or by layering. The average person will usually get the best results from layering, as cuttings are often very unsatisfactory. To propagate by layering, the bushes should be pruned severely in the autumn. This will induce a strong growth of young wood the next season. When these have made most of their growth, which will be early in July, the earth is heaped up around and through the bush until only the tips of the young shoots are left uncovered. The soil is packed down and then a covering of loose earth thrown over to retain moisture better. Most of the American varieties will have rooted well by autumn, and the young plants may be detached and planted in nursery rows either the same fall or the following spring, to be grown there for one season. English varieties usually take two years to root, and the soil must be left about the bushes for that time. Cuttings of American varieties will sometimes give fairly satisfactory results if made from well-ripened wood and treated as currant cuttings. The cuttings are made 6 to 8 inches or less in length, and buried in soil over winter. In spring they are set out in nursery rows, planting deep enough so that only one or two buds are above ground. Both American and English varieties may be propagated from greenwood cuttings in a greenhouse, or hotbed with bottom heat.

Soil, planting and culture.

The gooseberry is a moisture-loving plant, hence a soil should be chosen in which there will be a constant supply of water during the growing season. In dry soils gooseberries suffer very much in a dry time, the foliage often falling prematurely and the fruit being scalded by the sun. The soil should be a cool one. Moist soils are usually cool, but the surface of a sandy loam soil gets very hot in the summer, hence is not the best for this fruit. Well-drained, heavy clay loams are the most suitable for gooseberries as these usually are both cool and moist. The soil should have abundant plant-food easily made available. A good application of well-rotted manure thoroughly worked into the soil will do much to bring about these favorable conditions. The soil should be well prepared and made mellow as for a crop of roots. As gooseberries start to grow early in the spring it is usually preferable to plant in the autumn, and as the leaves drop early they may be planted in September and will be in good condition when winter comes. Well-rooted cuttings or layers may be used as plants. They should be set in rows about 6 feet apart and 4 feet apart in the rows.

Cultivation should be thorough to retain moisture and keep the soil cool, and as gooseberry roots near

1665. Ribes hirtellum in bloom. (×⅔)



1666. Leaves of Ribes hirtellum (Natural size)

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the surface, tillage should be shallow. Mulching with straw is sometimes advisable to keep the soil cool.

As the gooseberry makes much more wood than it is desirable to leave, severe pruning is necessary. English varieties are usually trained to a single stem, but this is not necessary, although the freer circulation of air when trained in this way may help to prevent the spread of mildew. The usual custom in America is to grow the gooseberry in bush form. The bush should at first be brought into a good shape by leaving a few of the strongest shoots regularly distributed to make an open head. Five or six of these shoots are quite sufficient to leave at first. As the bush gets older, new shoots are allowed to grow to take the place of the older ones, as the pruning should be done with a view to having only vigorous bearing wood. Fruit is borne on year-old wood and from spurs on older wood. It usually is not desirable to have any wood more than three years old. The best time to prune is in the autumn or winter. The weakest young shoots should be cut off at the ground, also all the stronger young shoots not required for fruiting or to take the place of the older branches to be cut away. The side shoots from the older branches should be headed back or cut out altogether so as to maintain a fairly open head, making it as easy as possible to pick the fruit and yet leaving sufficient wood to produce a good crop and shade the fruit from the sun, as in a hot dry time gooseberries are liable to be injured by scalding. When branches are more than three years of age they should be removed to make way for younger wood. It is advisable to cut out all branches which touch the ground as there will then be a better circulation of air, and the fruit will be kept off the ground. Gooseberries will often begin to bear the second year after planting, but there will not be a full crop until the fourth season. If the soil is kept in good condition by an annual application of well-rotted barnyard manure in the autumn, harrowed in the following spring, and if the bushes are kept sprayed and well pruned, the plantation will not need to be renewed for many years. Sometimes a plant is trained to a single stem (Fig. 1669), to secure extra fine fruit, but it is only a home-garden practice and scarcely to be recommended

1667. An American gooseberry, Ribes hirtellum. (×½)

Yield of gooseberries.

The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of the Pearl have averaged at the Central Experimental Farm, Ottawa, Canada, in five years at the rate of 12,402 pounds an acre each year, or, at forty pounds to the bushel, over 310 bushels an acre. The highest yield was in 1905, when five bushes of Pearl 6 x 4 feet apart yielded seventy-five pounds, or at the rate of 27,225 pounds an acre, equal to over 680 bushels.

The highest yield mentioned by Card in his work on "Bush Fruits," is at the rate of 450 bushels an acre, obtained at the Geneva Experiment Station, New York. He gives the probable range from 300 to 500 bushels an acre. Bailey gives the average as 100 bushels an acre.

European gooseberries.

In Great Britain the gooseberry is one of the most popular fruits, and great quantities of the product are grown there every year. They are used to a large extent for eating out of hand when ripe, but are much in demand for making jam. Owing to their large size and good flavor, and their popularity in Great Britain, they were early imported into America, but it was soon found that owing to the gooseberry mildew the European varieties could not be successfully cultivated in most places in which the gooseberry grows. Where the climate approaches nearest to that of Great Britain, and the northern and moister parts of Europe, and there is considerable moisture in the air, not very high summer temperatures, and considerable cloudy weather, the European gooseberry succeeds best. Even in gardens in which there is a great deal of vegetation giving off much moisture, and in which the soil is shaded and cool, good success is often obtained and almost or quite as fine gooseberries produced as in England, but such instances are the exception.

Heavy clay soils are most suited to the gooseberry and there is little use trying to grow the European varieties in light soils. Clay soils are cool, and with them it is easier to secure the conditions necessary to success. Various methods are recommended for growing European gooseberries free from mildew. Mulching the soil heavily with straw is one. Mulching the soil with coal-ashes is another. Shading the soil with laths set on a frame 8 to 10 feet high is another. All these methods are useful, but unless the air is moist above as it is cool and moist below, the conditions will be still more or less favorable for the development of the disease. The conditions of a thickly planted garden, where there is partial shade, seem the most favorable.

1668. Downing gooseberry.

Varieties of gooseberries.

American: Pearl, Downing (Fig. 1668), Josselyn (Red Jacket). Houghton is the hardiest.

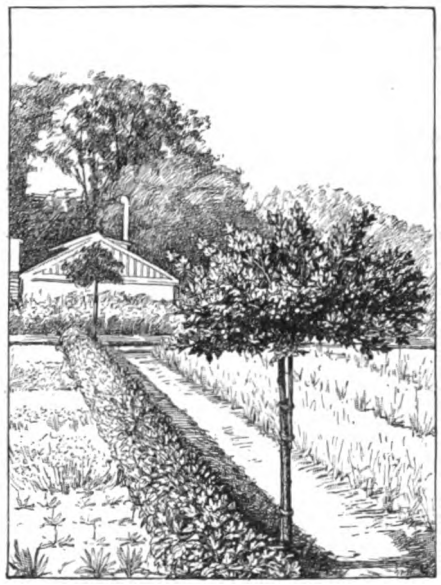
European (of most general adaptation): Whitesmith, Industry (Fig. 1671).

European (least affected by mildew at Central Experimental Farm, Ottawa, Canada): Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

European (grown by R. B. Whyte, Ottawa, Canada, under garden conditions): Triumph, Lofty, Green Ocean, Conn, Weatherall, Sportsman.

Scalding of the fruit.

In a very hot dry time, gooseberries are often scalded, become unfit for use and fall to the ground. If the gooseberries are planted in heavy, cool soil and the ground kept well cultivated and the currant-worm prevented from eating the foliage there will be little trouble. Unfortunately, in many plantations the foliage is very scant, either on account of poor cultivation or injury from the currant-worm, and it is under such conditions that the greatest injury occurs.



1669. Gooseberry trained in tree form.

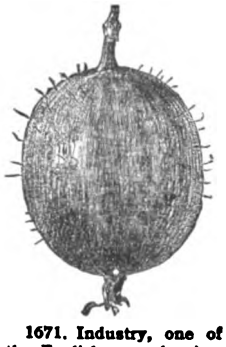
Insects and diseases affecting the gooseberry.

Currant-worm or imported sawfly (*Pteronus ribesii*, Scop.).—By far the best known of all the insects which injure currants and gooseberries is the currant-worm. The black-spotted dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of the temperate regions of North America. The white eggs are laid in rows along the ribs of the leaf on the lower side, toward the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent them ripening fruit the first year, and also reducing the quality of the crop of the following season. There are at least two broods in a season. The first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs and of about the same size as a house-fly, but with a more slender body. The female is larger than the male and has the body as well as the legs yellow. *Remedy:* For the first brood a weak mixture of paris green, one ounce to ten gallons of water, may be sprayed over the bushes, or a dry mixture one ounce of paris green to six pounds of flour may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood paris green must not be used, but white hellebore; this is dusted on as a dry powder; or a decoction of this powder, one ounce to two gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, so as to reduce the number of females which would lay eggs for the second brood.

1670. Crown Bob, an English gooseberry. (×¾)

Gooseberry fruit-worm (*Zophodia grossulariæ*, Pack.).—Just before gooseberries ripen, clusters of two or three may sometimes be noticed, which are prematurely colored, and which are joined together by the webs spun by the caterpillar of a small moth. These caterpillars are pale greenish white and sometimes have a reddish tinge. They live inside the berries and, when the contents of one berry are consumed, attack another near at hand, joining it to the first by a silken web. When full grown they fall to the ground and spin brown parchment-like cocoons, just beneath the surface of the ground. The moths, which are pale gray, marked with dark streaks and bands, are very rarely observed. They fly early in spring, and there is only one brood in the year. *Remedy*: The best method of controlling this insect, which fortunately is never very abundant, is to pick by hand the clusters of injured berries. It is thought that chickens and other poultry are useful in destroying the larvæ and chrysalids; and it is certain that, while chickens are very small, they are useful in a garden in destroying a great number of injurious insects. The old hen, however, should be kept securely cooped up and not allowed to run at large.

Gooseberry mildew (*Sphærotheca mors-uvæ*).—The gooseberry mildew has prevented the general culture of the European gooseberry in America. This disease attacks the leaves, twigs and fruit. When the attack is bad it destroys the foliage, covers the fruit and causes most of it to drop. It saps the growing shoots to such an extent that they do not ripen properly, and dry up without setting fruit-buds. It thus practically destroys the crop. The disease is apparent early in the season in the web-like covering which coats the leaves, shoots and fruit. This is the mycelium from which is given off the spores which propagate this disease. It is usually noticed first in the lower and most shaded parts of the bush. When the spores are being given off, the mildew has a powdery appearance. Winter-spores are formed later which germinate in the spring. As the mycelium and spores are both on the surface it might be thought this disease could be easily controlled, but the weather conditions in this country seem so favorable to the development of spores that the gooseberry mildew spreads with great rapidity, and constant and thorough spraying is necessary to prevent it from doing so. American varieties are seldom affected by gooseberry mildew, although occasionally they are slightly attacked. *Remedies:* So far, there has been no good remedy for the gooseberry mildew, but the most promising remedy is the lime-sulfur wash applied first when the buds are breaking and then at intervals during the growing season. So far, the best formulas and the best times to spray have not been accurately worked out. Potassium sulfide in the proportion of one ounce to two gallons of water has controlled the mildew in some



1671. Industry, one of the English gooseberries. (Natural size.)

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cases but to secure satisfactory results the weather must be favorable and the bushes sprayed from four to six times or more. In some cases it has been found that it is not practicable to control the mildew with this spray; furthermore under certain conditions the foliage of some varieties is injured by the spray. Bordeaux mixture when the leaf-buds are breaking and again just before blooming is a partial preventive.

Leaf-spot, rust (*Septoria ribis*).—The disease which causes the spotting of gooseberry leaves and their falling prematurely is the same as that which affects currants, and may be dealt with in the same way.

W. T. MACOUN.

GOOSEBERRY, BARBADOES: *Pereskia.*

GOOSEFOOT: *Chenopodium.*

GORDÒNIA (after James Gordon, an English nurseryman; died 1780). *Theàceæ.* Including *Franklínia.* Ornamental woody plants grown for their showy white flowers and handsome foliage.

Evergreen or deciduous trees or shrubs: lvs. alternate, petioled, entire or serrate: fls. solitary, axillary; sepals and petals 5; stamens numerous; ovary superior, 3–6-celled, each cell with 4 or numerous ovules; style slender, with a 3–6-lobed stigma: caps. 3–6-celled, woody, dehiscent, with few or many winged seeds in each cell.—About 15 species in Subtrop. and Trop. Asia and 2 in the S. Atlantic States.

The gordonias have very handsome shining foliage, and produce their large white flowers even on rather small plants. Only *G. alatamaha* is hardy north to Massachusetts, while the others are cultivated only in subtropical regions. They grow best in a somewhat moist, peaty, or sandy soil. Propagated by seeds, layers or cuttings from half-ripened wood under glass.

A. *Foliage deciduous.*

alatamáha, Sarg. (*G. pubéscens,* L'Her. *Franklínia alatamáha,* Marsh.). Shrub or tree, to 30 ft.: lvs. obovate-oblong, narrowed into a short petiole, sparingly serrate, bright green and shining above, pubescent below, turning scarlet in fall, 5–6 in. long: fls. short-pedicelled, pure white, about 3 in. across; petals roundish obovate, with crenulate margin, concave: caps. globular. Sept., Oct. Ga., but not found again since 1790. S.S. 1:22. Mn. 6:201. Gng. 7:167. M.D.G. 1899:25. F.E. 30:863. C.L.A. 2:34.—One of the few trees that flower in autumn. It does well in Mass. in sheltered positions or with slight protection, and blooms freely every year. A large tree in the Bartram garden, near Philadelphia, was long supposed to be the only living specimen of *G. alatamaha.* All other specimens in cult. are believed to have been prop. from the Bartram tree, which has lately died. All efforts since 1790 to rediscover this tree in the S. have failed.

AA. *Foliage evergreen.*

Lasiánthus, Ellis. LOBLOLLY BAY. Tree, to 60 ft., usually shrubby in cult.: lvs. obovate-lanceolate, narrowed into a short petiole, crenately dentate, dark green and shining above, glabrous, 4–6 in. long: fls. long-pedicelled, white, 2–2½ in. across; petals oblong-obovate; stamens short: caps. ovate. July, Aug. Va. to Fla. and Miss. S.S. 1:21. B.M. 668. I.T. 2:41.

axillàris, Szyszylowicz (*G. anómala,* Spreng.). Large shrub: lvs. oblanceolate, narrowed into a very short petiole, entire or serrate, dark green above, 3–6 in. long: fls. almost sessile, creamy white, 2–3 in. across; petals roundish obovate. Nov. S. China. B.M. 2047; 4019 (as *Polyspora axillaris*). L.B.C. 7:675 and B.R. 349 (as *Camellia axillaris*).

G. grándis, André. Corymbs few-fld., terminal; fls. white, large. R.H. 1906:520.—*G. jasánica,* Rollison. See Schima Noronhæ.

ALFRED REHDER.

GORSE: *Ulex europæus.*

GOSSÝPIUM (ancient name of the cotton plant). *Malvàceæ.* COTTON. Perhaps thirty or more species of herbs and shrubs of warm countries, although more than 100 have been described; some authorities reduce them to about three. They are grown for the fiber that is borne on the seeds. See *Cotton.* They are scarcely horticultural subjects, and therefore are not treated fully in this work.

Gossypiums are tall stout herbs, or tree-form bushes: lvs. large, alternate, petiolate, mostly prominently 3–9-lobed but sometimes entire: fls. white, yellow or purplish, provided with 3–5 large cordate calyx-like bracts; calyx entire or somewhat 5-lobed; stamens united into a column; ovary 3–5-celled, each cell 3–11-ovuled; style 3–5-lobed: fr. a loculicidally dehiscent caps., bearing seeds that are obovate, rounded or slightly angular, sometimes smooth, but usually covered with a short down or fuzz and a longer coat of brown, creamy or white hairs, called the lint.

The cottons of commerce belong, according to Lewton, to about eight distinct botanical types and may be divided into two main groups, the New World and the Old World cottons. The New World group includes American Upland cotton (*G. hirsutum,* Linn.); Sea Island and Egyptian cottons (*G. barbadense,* Linn.); and the tropical tree cottons of South America (*G. brasiliense,* Macf. and *G. peruvianum,* Cav.). The Old World cottons include the Levant cotton (*G. herbaceum,* Linn.), cultivated in southern Europe and western Asia; the oriental tree cotton (*G. arboreum,* Linn.), with yellow or purple-red flowers; the common cotton of India (*G. neglectum,* Todaro); and the Chinese and Japanese cottons (*G. nanking,* Meyen.).

Cotton (probably *G. herbaceum*) was grown in gardens in Delaware and Maryland in colonial times as an ornamental plant.

Two species have been offered as ornamental plants. **G. Dàvidsonii,** Kellogg, from Lower Calif. and Cerros Isls., woody, with handsome yellow fls. purple at the base, 1 in. long, and small cordate mostly entire lvs. **G. Stùrtii,** F. Muell., endemic in interior of Australia; shrub, several feet high, more or less marked with black dots: lvs. broadly ovate, entire, 1–2 in. long, glaucous: fls. large, purple with dark center; bracts to 1 in. long, cordate, entire, many-nerved, black-dotted. The common fiber-cottons are sometimes planted in northern gardens for curiosity, but they seldom make attractive plants where the nights are cool; sometimes they are seen in warm glasshouses, with other economic plants.

L. H. B.

GOUÀNIA (Antoine Gouan, 1733–1821, professor of botany at Montpelier, France). *Rhamnàceæ.* About 40 species of tropical shrubs, sometimes tall climbers, tendril-bearing: branches long and slender: lvs. alternate, petiolate, penninerved, entire or dentate: fls. in clusters, on axillary and terminal, elongated peduncles; disk 5-lobed; style 3-fid: caps. with 3 indehiscent berries.—This genus includes the "chawstick" of Jamaica, a rapid-growing, shrubby vine, with pretty heart-shaped lvs., grown sometimes for ornament in the extreme S. It is suitable for screening unsightly objects. The sts. are chewed in the W. Indies. Tooth brushes are made from the frayed ends and tooth-powder from the pulverized wood.

domingénsis, Linn. CHAWSTICK. Lvs. usually 1½–2 in. long, elliptical, glabrate, with distant serratures; veins tapering toward the margin: fls. very small, in slender interrupted axillary more or less leafy spikes: caps. winged, emarginate. W. Indies.

L. H. B.

GOURD. In England, a generic name for species of Cucurbita (which see). In America the term is used to designate those cucurbitous fruits that are hard-

shelled, and are used for ornament or for the making of domestic utensils. The gourd of history is probably Lagenaria. In the northern United States, the small hard-shelled forms of *Cucurbita Pepo* (var. *ovifera*) are commonly understood when the word gourd is used. The gourds in the American trade are referable to their species as follows:

Anaconda, *Lagenaria vulgaris.*
Apple-shaped, *Cucurbita Pepo* var. *ovifera.*
Bicolor, *Cucurbita Pepo* var. *ovifera.*
Bonnet, *Luffa.*
Bottle-shaped, *Lagenaria vulgaris.*
Calabash. *Crescentia Cujete,* yields the true calabash; but the calabash gourd is *Lagenaria vulgaris.*
Coloquinte, *Cucurbita Pepo,* var. *ovifera* (Colocynth is *Citrullus Colocynthis*).
Dipper, *Lagenaria vulgaris.*
Dipsaceous, *Cucumis dipsaceus.*
Dish-cloth, *Luffa.*
Egg, Egg-shape, *Cucurbita Pepo* var. *ovifera.*
Gooseberry, *Cucumis Anguria.*
Hedgehog, *Cucumis dipsaceus.*
Hercules' Club, *Lagenaria vulgaris.*
Maté Gourd, small form of *Lagenaria vulgaris.*
Mock Orange, *Cucurbita Pepo.*
Onion-shaped, *Cucurbita Pepo.*
Orange, *Cucurbita Pepo* var. *ovifera.*
Ostrich Egg, *Cucumis dipsaceus.*
Pear-shaped, *Cucurbita Pepo* var. *ovifera.* (Fig. 1134).
Powder Horn, *Lagenaria vulgaris.*
Rag, *Luffa.*
Serpent or Snake (not Snake cucumber, which is a Cucumis), *Lagenaria vulgaris* and *Trichosanthes.*
Sponge, *Luffa.*
Spoon, *Lagenaria vulgaris.*
Sugar Trough, *Lagenaria vulgaris.*
Tashkent, *Cucurbita Pepo* var. *ovifera.*
Turk's Turban, *Cucurbita Pepo* var. *ovifera.*
Vegetable Sponge, *Luffa.*
Wax Gourd, *Benincasa hispida.*

L. H. B.

GOURLIÈA (Gourlié, a personal name). *Leguminòsæ.* One or two spiny shrubs or small trees of Chile, one of which is listed in S. Calif., somewhat akin to Sophora and Cladrastis: lvs. odd-pinnate, the lfts. small: fls. small, orange-colored, in racemes or fascicles, papilionaceous; standard orbicular, wings obovate and undulate, keel short: pod short, indehiscent. **G. spinòsa,** Skeels (*Lucùma spinòsa,* Molina. *G. chilénsis,* Gay). CHAÑAL. Tree, 12–15 ft., with long thick branches ending in spines: lfts. 3 pairs, ovate: fls. orange-yellow streaked red, in short loose racemes: fr. about 1 in. diam., brownish, the pulp the flavor of jujube: wood yellow and hard, used for cabinet-making. Chile, at elevation of 1,500–5,000 ft.

L. H. B.

GOVÈNIA (J. R. Gowen, English gardener). *Orchidàceæ.* Terrestrial orchids of Trop. Amer., seldom cult., of perhaps a dozen species: rhizomes thickened into tuber-like enlargements or pseudobulbs, the sts. erect and few-lvd.: lvs. large, narrowed at base: fls. in simple racemes, medium in size, short-pedicelled, mostly white, cream-colored or yellow and more or less red-spotted; sepals and petals of about equal length, the former connivent; lip very short, without spur, jointed to column; pollinia 4, broadly ovate. *G. tingens,* Poepp. & Endl. Height 2–3 ft.: lf.-blade elliptic, about 8 in. long: fls. yellowish, with transverse purple lines, much larger than those of *G. superba;* segms. lanceolate to oblong. Peru. *G. supérba,* Lindl. Two ft.: fls. fragrant, yellow with red markings, sepals and petals acute: spike loose, erect. Mex. L.B.C. 18:1709. *G. sulphùrea,* Reichb. f. An odd species with onion-like pseudobulbs: lf.-blade cuneate-lanceolate and acuminate: fls. rather large; sepals sulfur-yellow; petals white with yellowish margin and purple lines; lip cordate-oblong, white with dark brown at apex.

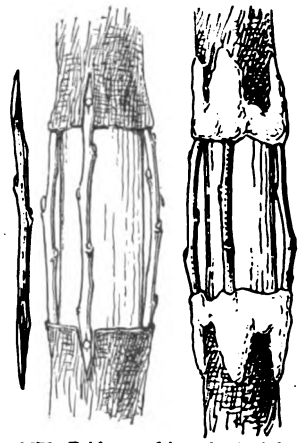
L. H. B.

GRABÒWSKIA (H. F. Grabowsky, German apothecary and botanical author). *Solanàceæ.* A half-dozen or more spiny shrubs of Trop. and extra-Trop. S. Amer., with small violet or pale blue or whitish fls. borne singly at the nodes and in clusters on the ends of the branches, and oblong or obovate entire sometimes fleshy lvs.: calyx 5-toothed or becoming 10-toothed after flowering; corolla funnelform, with short tube and 5-lobed spreading limb; stamens 5, exserted: fr. drupe-like with 2 pyrenes. **G. boerhaaviæfòlia,** Schlecht. (*G. glaùca,* Hort.), of Peru, is offered in Calif. It is a lycium-like scrambling or wide-spreading bush with small lvs. alternate and tufted, with spines ¼in. long in the axils and the shorter branches often also sharp and spine-like: fls. whitish or pale blue, not conspicuous, in clusters of 3–5 or solitary: berries scarcely ½in. long. B.R. 1985.—In Calif., the plant has a good gray-green foliage and a graceful drooping habit, therefore making it adaptable for planting compositions in landscapes.

L. H. B.

GRAFTING, Multiplication by. Grafting is the operation of inserting a part of one plant into another plant or part with the intention that it shall grow and produce its kind.

The practice of grafting, together with all the reasons, consequences and results, constitutes a department of knowledge known as *graftage.* The term *grafting* is ordinarily restricted, in popular speech, to propagation by means of short twigs or cions, and *budding* is used to designate the insertion of single buds that are severed from the branch on which they grew; but these distinctions are not fundamental. *Stock* is the plant or part on which the grafting is done. *Cion* (*scion, sion*) is the part inserted into the stock, although it is usually restricted to cuttings of twigs, and does not include detached buds. In many writings the word is spelled *scion,* but the other is shorter and it was a very early horticultural term, many old horticultural writings using *cion* and *cyon. Scion* is apparently later, and usage is not uniform. The word *graft* is sometimes used in the sense of *cion,* but it would better be used for the completed thing—the new plant or part made by the joining of cion and stock.



1672. Bridge-grafting. At the left, a cion; the cions in place; at the right, the ends waxed.

Grafting is not always employed for purposes of propagation. It may be a reparative process. What is known as bridge-grafting is of this kind. Wounds or girdles may be bridged by cions, as in Fig. 1672 (after Hedrick), for the purpose of supplying new tissue to connect the parts. Here the edges of the girdle are trimmed to the fresh firm tissue, cions whittled wedge-shape at each end are inserted, bandages are drawn around the trunk to hold the free edges of the bark and the ends of the cions, and wax is poured over the work. This operation is performed in spring, with dormant cions. The buds should not be allowed to throw out shoots. If the cions are placed close together, they will soon unite along their sides and make a continuous covering of the wound. Writing of bridge-grafting, Hedrick says (N. Y. Sta. Circ. No. 17): "Its most important use is to preserve trees injured or girdled by rodents or disease. Any ragged or diseased edges should be cleanly cut away, a longitudinal slit should be made in the bark, both above and below the wound, and the edges of the slits loosened slightly. A cion should then be cut 2 or 3 inches longer than the space to be bridged, one side beveled off at both ends (Fig. 1672), and inserted in the slits, its beveled face against the wood

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of the trunk. In order to guard against any accidental displacement it would be well to drive a small tack or nail through each end of the cion, which, however, must not be split in the operation. Other cions in a like manner may be inserted at intervals of about 2 inches over the entire injured surface. The ends of the cions should be covered with wax but it is not necessary to cover all the bridged portion of the trunk. If the tree operated upon is small and likely to weave in the wind it should be tied firmly to a strong stake as such movements might tear apart the tender uniting surfaces."

Cions are sometimes inserted freely in the stub left by a large broken limb, for the double purpose of providing other shoots to take the place of the branch and of facilitating the healing of the wound. Sometimes cions are inserted in limbs on a one-sided or misshapen tree for the purpose of securing better growth on that side, the variety perhaps being the same as that of the tree itself.

Another reason for grafting is to produce some radical change in the nature of the cion, as rendering it more dwarf, more fruitful, or otherwise changing its habit. Still another office is to adapt plants to adverse soils or climates. An example is the use of the peach root in the southern states upon which to work the plum, as the peach thrives better than the plum in sandy soils. The practice in Russia of working the apple on roots of the Siberian crab is an example of an effort to make a plant better able to withstand a very severe climate.

In general, however, grafting is employed for the purpose of multiplying or perpetuating a given variety, mostly of woody plants. It is used with plants that do not bear seeds, or in which the seeds do not come true or are difficult to germinate, or when the plants do not propagate well by cuttings or layers. It is also employed to increase the ease and speed of multiplying plants.

In common practice, the effect of the stock on the cion is rather more mechanical or physical than physiological or chemical. The influences are very largely those associated with greater or less growth. As a rule, each part of the combined plant—the stock and cion—maintains its individuality. There are certain cases, however, in which the cion seems to partake of the nature of the stock; and others in which the stock partakes of the nature of the cion. There are recorded instances of a distinct change in the flavor of fruit when the cion is put upon stock that bears fruit of very different character. There are some varieties of apples and pears which, when worked on a seedling root, tend to change the habit of growth of that root. Examples are Northern Spy and Whitney apples, which, when grafted on a root of unknown parentage, tend to make that root grow very deep in the soil. All these instances seem to be special cases, or exceptions to the general rule that each part maintains its individuality. Reasons for this change of nature in these cases have not been determined, and in most cases such results are not to be predicted. The most marked effect of stock on the cion is a dwarfing influence. Dwarfing may be expected whenever the stock is of a smaller stature than the cion. The most familiar example is the dwarf pear, made by working the pear on quince stock. Supplying a plant with a slow-growing root is only the beginning of the making of a dwarf. The plant must be kept dwarf by subsequent pruning and other care. There is comparatively little demand for large-growing forms of woody plants, whereas there is much demand for dwarf forms. See *Dwarfing*, page 1082.

The limits within which grafting can succeed are to be determined only by experiment. These limits are often within the species, and usually within the genus, but there are instances in which plants of distinct genera intergraft with success, as in some of the cacti. In general, the closer the affinity of cion and stock, the better the union. When stock of the same species can not be secured, it is allowable to chose another species. Thus it was for a time impossible to secure Japanese plum stocks upon which to grow the varieties of Japanese plums, and peach, Marianna, myrobalan and domestica plum stocks have been used, and are used to this day. In some cases another species grows more readily from seed, is cheaper, is less liable to fungous injury in the nursery, or has some other practical advantage. Thus, most domestica plums (*Prunus domestica*) in the North are worked on the myrobalan (*P. cerasifera*); many sweet and sour cherries (*Prunus Avium* and *P. Cerasus*) are worked on the mahaleb (*P. Mahaleb*); many kinds of roses are worked on manetti and *Rosa multiflora* stocks.

From time to time there arises an agitation against grafting, particularly in the Old World. Cases of poor unions and the difficulties of sprouting from the root or stock are cited as proofs that graftage is injurious and devitalizing. But these are examples of poor results. They show what should not be done. Properly performed, on plants of proper affinity, graftage is not devitalizing. It is essential to modern horticulture.

The ways or fashions of grafting are legion. There are as many ways as there are ways of whittling. The operator may fashion the union of the stock and the cion to suit himself, if only he apply cambium to cambium, make a close joint, and properly protect the work. Thus, Thouin in his "Monographie des Greffes," 1821, describes 119 kinds of grafting. All kinds of grafting may be classified into three groups:

1. Bud-grafting or budding. In the old days called inoculation.
2. Cion-grafting, or what is now thought of as grafting proper.
3. Grafting by approach, sometimes called inarching.

Early practice.

Grafting is one of the oldest of the arts of plant-craft. It is probable that the real art of grafting was held more or less as a professional or class secret in the ancient world, for the writers seem to have only the vaguest notion of its possibilities and limitations. Virgil writes (Preston's translation):

> But thou shalt lend
> Grafts of rude arbute unto the walnut tree,
> Shalt bid the unfruitful plane sound apples bear,
> Chestnuts the beech, the ash blow white with the pear,
> And, under the elm, the sow on acorns fare.

It seems to have been a popular misconception that any kind of plant will grow on any other. Pliny asserts that the art of grafting was taught to man by nature. Birds swallow seeds, and these seeds, falling in "some cleft in the bark of a tree," germinate and make plants. "Hence it is that we see the cherry growing upon the willow, the plane upon the laurel, the laurel upon the cherry, and fruits of various tints and hues all springing from the same tree at once." This, of course, is not grafting at all, but the implanting of seeds in earth-filled chinks and cracks, in which the plants find a congenial foothold and soil. But the ancients have left us abundant testimony that genuine grafting was employed with success. Pliny describes a cleft-graft. He gives several precautions: the stock must be "that of a tree suitable for the purpose," and the graft must be "taken from one that is proper for grafting; the incision or cleft must not be made in a knot; the graft must be from a tree "that is a good bearer, and from a young shoot;" the graft must not be sharpened or pointed "while the wind is blowing;" "a graft should not be used that is too full of sap, no, by Hercules! no more than one that is dry and parched;" "it is a point most religiously observed, to insert the graft during the moon's increase."

Herein are seen the beginnings of the grafting practices of the present day, together with some practices of layering. Sharrock treated the whole subject of

grafting under the head of "Insitions," and here he minutely describes the cleft-graft, and speaks of it as "the common way of grafting." The practice which we now know as inarching or grafting by approach, he significantly calls "Ablactation" (that is, *suckling* or *weaning*). Now that so much is said about the proper and

1673. Sharrock's illustration of grafting. 1672.

careful selection of cions, it is interesting to read Sharrock's advice on this subject: "Good bearing trees are made from Cyons of the like fruitfulness. . . . Cyons are best chosen from the fairest, strongest shuits, not from under shoots or suckers, which will be long ere they bear fruit, which is contrary to the intention of grafting." But we have seen that Pliny gave similar advice before the Christian era,—which is only another illustration of the fact that most of our current notions have their roots deep in the past.

The accompanying cut (Fig. 1673) reproduced two-thirds size from Robert Sharrock's "History of the Propagation and Improvement of Vegetables," 1672, shows various kinds of grafting in vogue over two centuries ago. Following is the literal explanation of the plate:

a. Denotes the ordinary cutting of the bark for inoculation.
bb. The sides of the bark, lifted up for the putting in of the shield.
c. The shield taken off with the bud, which lies under the stalk of the leaf cut off.
ln. The shield put into the stock to be bound up.
d. The bark cut out in an oblong square, according to another usual way of inoculation.
g. The shield cut out for the fitting the disbarked square.
m. The same shield put into the stock.
f. A variation of the forementioned way, by cutting off the upper part of the oblique square, and binding the lower part down upon the shield.
o. The shield so put in to be bound up.
e. Another variation by slitting the bark, that the bud and leaf may stand forth at *e*, and the bark slit be bound down upon the shield.
h. A cross cut for inoculation.
i. The same cross cut lifted up in this figure, somewhat too big.
k. The shield cut off to be put therein.
p. The shield put in.
g or *q*. The cut of cyon or stock for whip-grafting.
r 7. The cut of cyon and stock for shoulder-grafting.
s. The cut of the cyons, and slit of the stock for grafting in the cleft.
x. The stock set for ablactation or approach.
u. The cyon of the branch for the same operation.
1 2. The branch that is to be taken off by circumposition.
3. The branch that bears up the mould to the disbarked place.
4. The branch of a carnation to be laid.
5. The joynt where the slit begins.
6. The next joynt where the slit is propped open, with a piece of a carnation leaf put in.

Budding.

The operation of budding consists of inserting a single detached bud underneath the bark of the stock. It is employed only in stocks of small diameter, and preferably in those not more than one year old. The operation may be performed whenever the bark will peel and whenever mature buds may be secured. The bark will peel in early spring and again in late summer or early autumn, and the operation of budding in the open ground is therefore performed at those times. In the spring the buds are secured from twigs of the previous season's growth. At the second budding season, in late summer or early autumn, the buds are secured from growing twigs of the season. At that time of the year the buds will be sufficiently developed to be easily recognized and handled.

Budding is much employed in nurseries. Peaches, cherries, plums, and most stone fruits, are habitually budded rather than cion-grafted. In the East, apples and pears are usually budded in the nursery; but in the West apples at least are usually root-grafted. Third-rate stocks are sometimes set in nursery rows and budded the following July.

It is practicable to insert buds rather than cions in the tops of young trees, for the purpose of changing the tree into a different variety. Sometimes the buds are inserted in limbs two and three years old; but it is usually preferable, if the tree is of some age, to cut back the tree somewhat heavily the previous season or the previous spring, to get a growth of suckers into which the buds may be set.

1674. Stick of buds. (×⅓)

The cutting from which the buds are taken is known to budders as *a stick* (Fig. 1674). In early spring-budding, this stick is the last year's growth of the variety which it is desired to propagate. Later in the season, the stick is the twig grown in that season. Not all the buds on the stick are strong enough or good enough for budding. The budder will usually discard the weak ones at the top and at the bottom, unless he is very much pressed for buds, as may be the case with new or rare varieties. If the stick is taken late in the season the leaves will be on; but these are quickly cut off to prevent too much evaporation from the cutting. About ¼ inch of the leaf-stalk is left to serve as a handle to the bud.

Shield-budding.

The ordinary operation of budding is shown in the illustrations. It is known as shield-budding, from the shape of the removed bud. With a thin-bladed, sharp knife, the operator slices off the bud by placing his thumb beneath the bud and making a deft and quick stroke of the blade. Just under the bud he cuts a little into the wood. Some budders afterward remove this bit of wood; but this is not essential. If this wood is somewhat hard and dry, or if it carries some pith, it may then serve to dry out the bud or to prevent inti-

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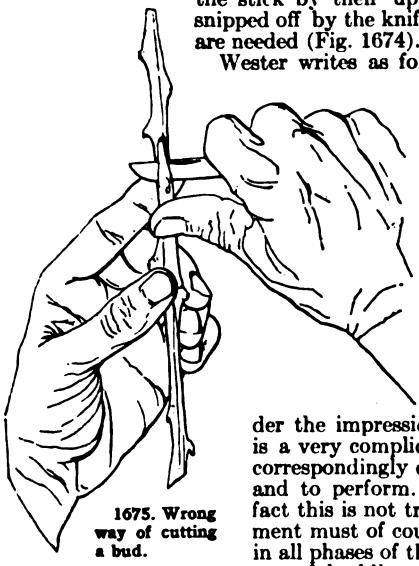
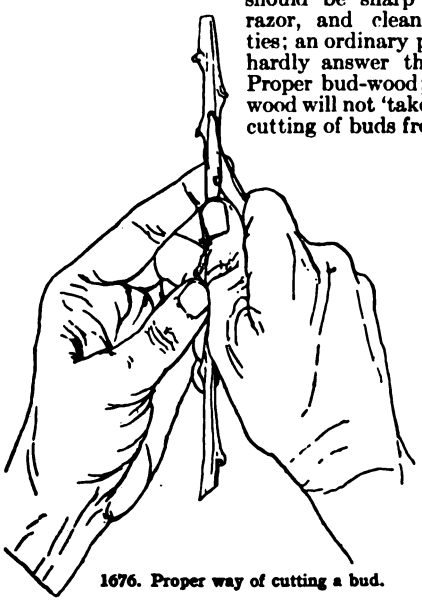
mate contact with the cambium of the stock. In ordinary operations this truncheon of wood is not removed. Most budders cut all the buds on a stick before they insert any of them; but they are allowed to hang to the stick by their upper ends, being snipped off by the knife as fast as they are needed (Fig. 1674).



1675. Wrong way of cutting a bud.

Wester writes as follows on the requirements in budding citrus fruits (Bull. No. 27, Bur. Agric., Philippine Isls.), and the directions will apply to other plants; and he gives pictures (Figs. 1675, 1676) of part of the manual operation: "Many people are under the impression that budding is a very complicated operation, correspondingly difficult to learn and to perform. As a matter of fact this is not true. Some judgment must of course be exercised in all phases of the work, but the art of budding itself is a mere matter of manual skill that anyone should be able to master who is at all deft in the handling of a knife. Necessary essentials for success are: (1) Stock plants in condition for budding; i. e., the flow of sap must be good so that the bark separates readily from the wood. (2) A suitable budding-knife, the edge of which should be sharp and keen as a razor, and clean of all impurities; an ordinary pocket-knife will hardly answer the purpose. (3) Proper bud-wood; immature bud-wood will not 'take' and the proper cutting of buds from old and hard bud-wood is difficult. (4) The bud-wood should never be allowed to dry out by being exposed to the air or sun. (5) The buds should be inserted immediately after being cut, and the bud tied at once. (6) No foreign matter or water should be allowed to enter the bud incision. (7) The bud should be cut so that there is no break or tear in its tissues."



1676. Proper way of cutting a bud.

The stock is first prepared by removing all the leaves and twigs from the area to be budded. In the case of nursery stock, it is customary for a boy to strip the lower leaves of the stock a day or so in advance of the budding. If the stripping is done three or four days or a week before the budding, it will sometimes cause the bark to set and, therefore, interfere with the operation. Nursery trees are usually budded as near the ground as the operator can work—not more than 2 or 3 inches above the surface. In most cases, the budder prefers to set the bud on the north side of the stock, that it may be shaded from the hot sun.

A T-shaped incision, just through the bark, is made on the stock (Fig. 1677). The crosswise incision is usually made first. As the operator takes his knife from the last incision, he gives it a deft turn to right and left and loosens the flaps of the bark, so that the bud is easily inserted. The bud is now taken from the stick and shoved into the matrix underneath the bark until it is entirely within the cleft (Fig. 1678). A boy follows and ties the bud, making four or five deft turns and holding the strand by covering the lower end underneath one of the turns (Fig. 1679). No wax or other mastic is used. Any soft strand may be employed for the tying. It was the old custom to use bass-

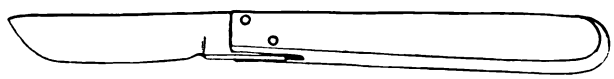
1677. Shield-budding. (×½)

1678. The bud set in the matrix. (×½)

1679. The bud tied.

wood bark, which was taken in the spring from the inner layers of the bark of the basswood tree. This material was then macerated in water and afterward pounded to make it soft. Yarn is also used. At present, raffia is universally employed. This is the stripping of an oriental palm, and it can be bought in the market and is cheaper than home-made materials; it is also better. It is customary to lay it on the ground or in a damp place over night to soften it and to allow the operator to flatten out the strands. This raffia is cut in the length to suit before the tying is begun, and the bunch of strands is then held underneath the belt or carried in a box. For budding, the operator prefers a small, thin-bladed knife, with a rounded or thumb-shaped cutting surface (Fig. 1680). Budding knives are regularly on the market.

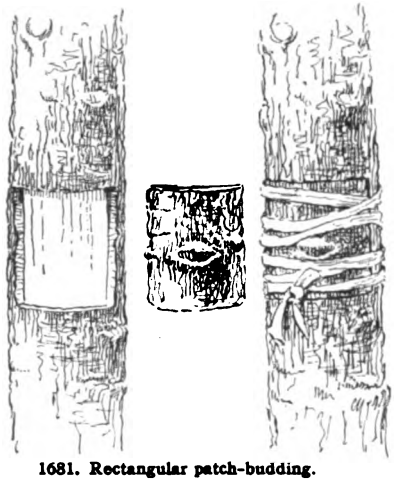
When budding is performed late in the season, the bud does not throw out a shoot until the following spring. It merely grows fast or "sticks" to the stock. Two or three weeks after the setting of the bud, the bandage is cut so that it will not restrict the swelling of the stock. If the stock grows very rapidly, it may be necessary to cut the bandage before that time. Nothing more is done with the tree until the following spring, at which time the whole tree is cut off about 1 inch above the bud. This one bud now throws out a shoot and makes a very heavy growth, being impelled by the strong root. In this first season of growth, a peach tree will attain the height of 4 to 6 feet, and be ready for market in autumn. If the bud is set early in the spring it will throw out a shoot the same season; but ordinarily it would not make the growth in one season that the bud does in the other case. Spring-budding in the open air is rarely employed in nursery practice. It is sometimes used in the top-budding of established



1680. Budding knife. (×½)

plants. In all budding practices, it is important to keep down the suckers from the stock.

In the South, a peach tree may be large enough in June, if the seeds are planted in February or March, to be budded. The bud will grow the same year, and by



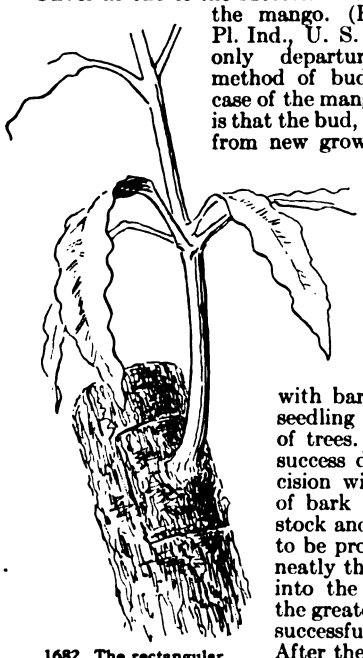
1681. Rectangular patch-budding.

autumn will make a salable tree. This operation of budding in early summer on stocks which grow that year is known as June-budding. As a rule, June-budded trees are smaller than fall-budded trees; but they can be secured one year sooner.

Other forms of budding.

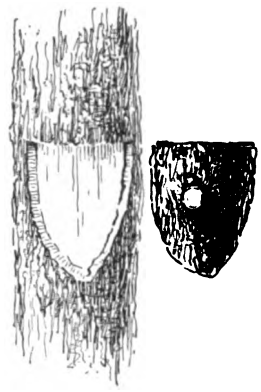
There are many ways of shaping the bud. These modes may have distinct advantage in certain plants, because of the way in which the bark holds its shape, of the relation to the drying out of the parts, and otherwise.

The rectangular-patch method is illustrated by Sharrock (*d*, *g*, *m*, Fig. 1673). It is recently described by Oliver as one of the successful methods of propagating the mango. (Bulletin No. 46, Bur. Pl. Ind., U. S. Dept. Agric.): "The only departure from Sharrock's method of budding as used in the case of the mango at the present time is that the bud, instead of being taken from new growth, must be selected from wood old enough to have lost its foliage. This means that the bud-wood will sometimes be over two years old. The use of bark of this age and even older insures success in budding the mango, as it unites rapidly with bark of a similar age on seedling stocks or on branches of trees. To a certain extent success depends upon the precision with which the section of bark is removed from the stock and also from the variety to be propagated, as the more neatly the bud section is fitted into the space prepared for it the greater the probability of a successful union (Fig. 1681). After the section of bark from the bud-stick is nicely fitted in



1682. The rectangular patch-bud growing.

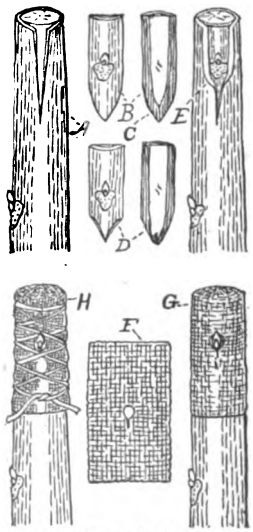
place, and before tying, a small quantity of grafting-wax should be smeared over the parts where they come together and tied firmly in place with thick strands of raffia. This effectually prevents the admission of air to the spaces which, no matter how carefully the operation be performed, exist between stock and cion; it also serves to prevent moisture from gaining access to the cut surfaces. The cut surfaces and all but the bud should then be covered with strips of cloth dipped in melted paraffin, wrapping being begun at the lower part, so that when finished water will not gain entrance to the wrapped section of bark. If that part of the stock where the bud is tied be exposed to the sun, it is always advisable to furnish shade which is best supplied by strips of paper tied above the bud and extending down over it. Two weeks may be allowed to pass before an examination is made. The cloth wrappings may then be removed and the raffia should be loosened if there is danger of its cutting into the bark. When a sufficient time has elapsed to make certain that a union has taken place, part of the top of the stock should be removed in order to encourage the bud to start. This it will do with very little coaxing. When sufficient growth has been made, all of the stock above the bud may be removed and the cut part coated with liquid grafting-wax or tar to exclude moisture and prevent rotting." Fig. 1682 shows the successful growth of the patch-bud.



1683. Spade-budding.

The spade-shaped bud, shown in Fig. 1683, has been employed with the mango and other plants. The pointed end makes it possible, according to Oliver, "to push the bark of the cion down tight against the bark of the stock; the top part is then cut off square with the transverse cut in the bark of the stock, and is pressed firmly into position previous to tying and waxing in the usual way." These two forms of budding are given here only for the purpose of illustrating interesting methods, and not necessarily to advise their use.

Improved methods of budding the pecan have been developed in Texas by Charles L. Edwards. He prefers spring-set buds, as they have the whole growing season before them and make salable trees by autumn. The summer-bud makes only a start before autumn, at best; most of them remain dormant till spring, and not a few dry out and perish. One method is shown in Figs. 1684, 1685. The stocks are cut off bodily, and straight across. A slit is then made in the bark at the top (A), and the bark opened to receive the bud. The buds are cut like shield-buds for peaches and plums (B, front and back views), but in addition, the bark is cut away from the lower end of the bud (C), reducing it to a point so it will slip into place easily (D). By removing the thick rim of bark from the lower end of



1684. Crown-budding the pecan; 1685 (below), the bud wrapped and tied.

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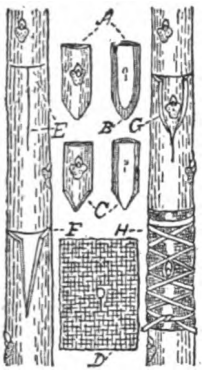
the bud, the sap from the stock will enter it easily, and force it into immediate growth, whether put on in early spring or as late as September. At E the bud is shown in place, and the flaps pared. To put on the wrapper, use an oblong little square of waxed cloth with an eyelet in the middle for the bud to emerge from (F). In preparing the cloth for these wrappers, use only beeswax, not grafting-wax for this purpose. Be sure to tie on the wrappers firmly, and see also that they cover the entire top of the stock, leaving no part of the wounds made by the knife uncovered. A modified shield-bud is used by Edwards. In Fig. 1686, the part marked A shows the outside and inside of the bud as commonly made for the pecan; B shows the thick rim of bark at the lower end. The modification consists in trimming away the lower end, as at C; also in paring away part of the flap, as at G. At E is the regular slit; F, the bark opened to receive bud; D, waxed wrapper; H, wrapper tied on. See *Pecan*.



1686. Modified shield-bud.

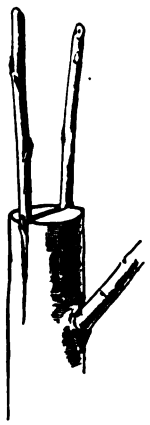
Proper time to bud. (Hedrick.)

Inasmuch as the various kinds of trees used as stocks for budding vary greatly in length of their growing season, it naturally follows that the time during which they may be budded will vary accordingly. In a normal season, the figures for New York are about as follows:

Rose	July 1 to July 10.
Pear	July 10 to July 15.
Apple	July 15 to August 1.
Plum (St. Julien stock)	July 15 to August 1.
Plum (Myrobalan stock)	August 15 to September 1.
Cherry (Mazzard stock)	July 20 to August 1.
Cherry (Mahaleb stock)	August 20 to September 1.
Quince	July 25 to August 15.
Peach	August 20 to September 10.

Grafting.

Grafting proper is the operation of inserting a twig or a woody cion into a stock. They may be classified in respect to the place or position of the cion on the stock:


1687. Cleft-grafting.

1688. The cleft-graft waxed.

1689. Cleft-graft cion.

Root-grafting, or the insertion of the cion in the root of the stock;

Crown-grafting, or the insertion of the cion at the crown (surface of the ground);

Stem-grafting, or the insertion of the cion in any part of the main stem or trunk;

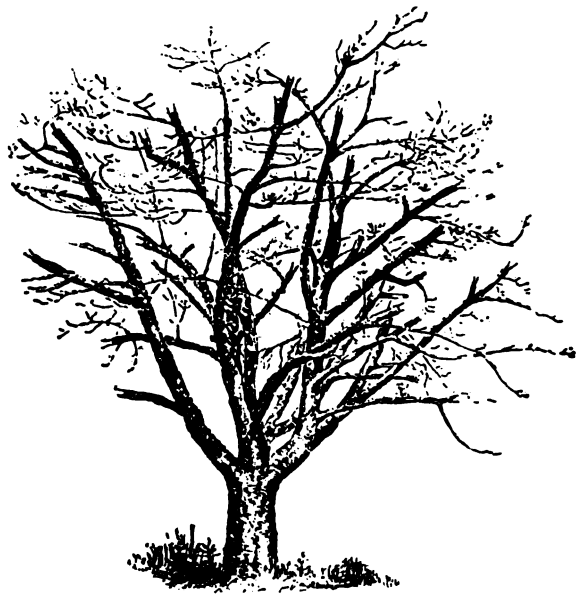
Top-grafting, or the insertion of the cion in the top or branches of the plant.

Grafting may again be classified in respect to the maturity of the cion: dormant wood grafting; and soft-wood or herbaceous grafting, in which the cion is taken from green or growing wood.

It is customary to classify grafting on the way in which the union is made. There are few general types in common use in this country: as cleft-grafting, whip-grafting, veneer-grafting (side-grafting, bark-grafting).

Cleft-grafting.

Cleft-grafting consists in splitting the stock and inserting a wedge-shaped cion into the cleft. It is


1690. One way of cleft-grafting an old tree.

employed only in rather large stocks, preferably in those an inch or more in diameter. The stock is cut off, and it is split with a knife or tool made for the purpose. The cleft is then held open by a wedge and the cions are inserted in the side of the cleft in such position that the cambiums of the stock and cion are in contact (Fig. 1687). The whole surface is then securely waxed, to prevent evaporation and to protect the wounds from the sun (Fig. 1688). Cleft-grafting is performed in early spring. The cions are taken some time previously from the last year's shoots. They are stored in a cellar or other cool place in order that they may be perfectly dormant. It is customary to cut them of three buds' length; but if the shoot is very long-jointed and if the variety is new or rare and the wood therefore scarce, they may be made of one or two buds. The wedge-shaped part should be somewhat thicker on the outside so that it may be clasped tightly in the cleft (Fig. 1689). It is customary to have one bud near the top of the wedge. Although this bud is covered with wax, it is the most likely to grow, since it is nearest the source of food-supply and is less injured by external conditions. It pushes through the wax. It is customary to insert two cions in all stocks, even though only one branch is desired. By inserting two cions, the chances of success are doubled, and the wounds heal better if a twig grows on either side. After a year or two, one of the cions may be cut off if desired.

Cleft-grafting is the method usually employed in the top-grafting of fruit trees, as apples, pears, plums and cherries. Old peach trees are rarely changed over to a

new variety. If they are, budding is employed, as already suggested: the limbs are headed back so that new wood is secured in which the buds may be set. It is important, in all top-working of fruit trees, to keep down the suckers which spring up around the cion, and which sometimes completely choke it. In changing over the top of a fruit tree, all the leading branches should be grafted (Fig. 1690). It is well to stand at some distance from the tree and make a mental picture of how the tree will look when the new top is secured: the grafts should be set in approximately a radius from the center of the tree. It is rare that the stock should be larger than 2 inches in diameter where the cions are set. On some of the main branches it may be necessary to graft side branches lower down in order to fill the top and to afford footholds to pickers and pruners. It will require from three to four years to change over a tree in full bearing to a new variety. Each year a little more of the original top is removed, and the cions take more and more of the space.

1691. Whip-graft.

Grafting-wax is of many kinds, but the most serviceable for applying with the hands in the open air is made by melting together one pound (by weight) of rendered tallow, two parts of beeswax and four parts of resin. The melted liquid is poured into a pail or tub of water, when it immediately hardens. It is then pulled until it is light-colored and develops a grain. It is then put away for future use, and will keep indefinitely. When the wax is used, the warmth of the hands will cause it to soften. The hands should be greased to prevent it from sticking.

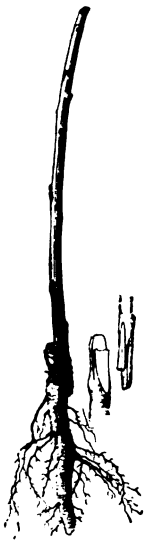
For a softer wax, more tallow may be used; or linseed oil may be substituted, but because of adulteration of the oil the results are not always reliable.

Alcoholic waxes, or plastics, are sometimes made, to be applied with a brush or swab; on application, the alcohol disappears and the material hardens. A standard formula (Lefort's) is: best white resin, one pound; beef tallow, one ounce; melt, then remove from fire and add eight ounces alcohol. Keep in tightly closed bottles. Sometimes a teaspoonful of turpentine is added.

1692. Whip-graft, before waxing.

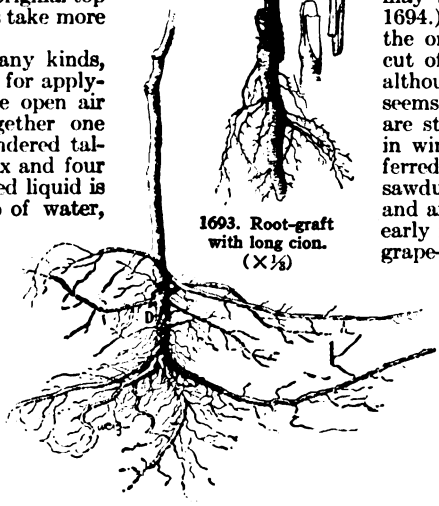
Whip-grafting.

Whip-grafting, or tongue-grafting, is employed in the nursery and on very small stocks. It is not used in top-grafting except now and then on small limbs. The cion and stock should be of approximately equal size. Each is cut off in a slanting direction, and a split or tongue is made near the middle. The same shape is given to cion and stock. The pictures sufficiently illustrate how the work is done. (Figs. 1691–1693). The object of the tongue is to hold the parts together securely; it also presents more contact. The cion is then bound to the stock, preferably by means of waxed cord. If the graft is above ground, the wounds should be thoroughly waxed over the string. If the graft is below ground, the tie will be all that is necessary: the moist earth packed around the wound will prevent evaporation and protect it.



1693. Root-graft with long cion. (×⅓)

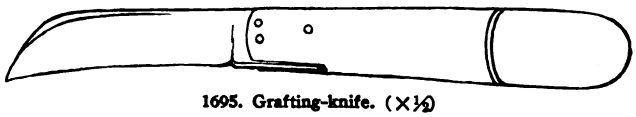
The chief use of the whip-graft is in root-grafting, which is employed largely on apples and mostly at the West. In the East, other things being equal, budded apple trees are preferred to root-grafted trees. In the West, however, it is necessary to have apple trees on roots of known hardiness. The seedling stocks are not of known hardiness, even though the seeds have come from the hardiest varieties. It is therefore customary to use cions 6 to 12 inches long, grafted on pieces of roots 2¼ to 4 inches long. (Fig. 1693.) The graft is set so deep that only the top bud of the cion projects above the surface. The piece of root acts as a nurse, and roots may start from the cion itself. (Fig. 1694.) When the tree is transferred to the orchard, the original root may be cut off in case it is not very vigorous; although this is not done if the union seems to be good and the foster roots are strong. This root-grafting is done in winter (December and January preferred); the grafts are stored in clean sawdust, sand or moss in a cool cellar, and are set in nursery rows in the open early in the spring, after the manner of grape-cuttings.



1694. Tree grown from a long-cion root-graft. The union is at D.

The waxed string, with which the whip-grafts are tied, may be made by dropping a ball of yarn into melted grafting-wax. In five minutes the wax will have penetrated the ball, but the strand can readily be unwound. The best material for this purpose is No. 18 knitting-cotton. This is strong enough to hold the work together, and yet weak enough so that it may be broken in the hands without cutting the fingers. It will ordinarily decay during the year, and thereby not interfere with the growth of the tree. If the grafting is performed in a room at a living temperature, the waxed string should be soft enough to stick to the stock without being tied. Four or five turns are made around the union. Waxed manilla paper, cut in narrow strips, is also used; also single strand cotton "chain" or warp-thread, either waxed or not waxed.

Any sharp knife with a handle large enough to be grasped readily is useful for whip-grafting. The blade should be thin, and the steel of best quality. The handle should also be strong. Fig. 1695 shows a common form of grafting-knife. Good shoe-knives may be used. This and similar knives are in the market. A hone and whetstone should be near at hand, for the edge should be keen.



1695. Grafting-knife. (×½)

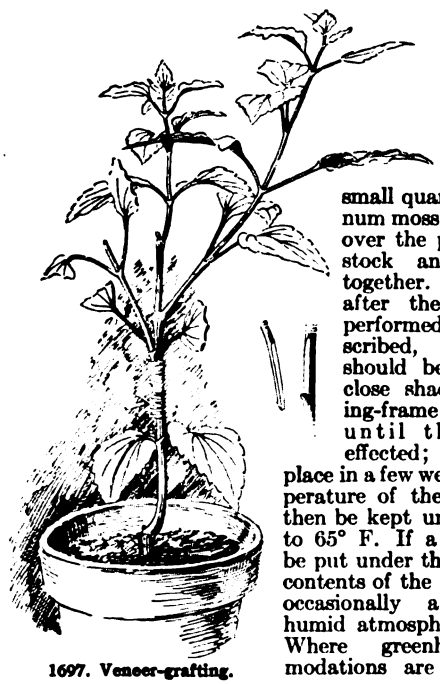
Veneer-grafting.

This style of grafting, which is considerably used under glass with fancy and ornamental plants, consists in simply champering the sufaces of cion and stock and applying the one to the other. (Fig. 1696.) The cion is bound to the stock by raffia or other material. If

the graft is in the open, the wounds are thoroughly waxed; but in the house they may be covered merely with moss. This style of union is used with herbaceous plants, as well as on hard wood. Sometimes the stock is severed at the point of union, as in Fig. 1696; but in other cases it is not severed nor headed back until the cion has taken hold (Fig. 1697). In the latter case, the stock is not injured in case the graft does not grow.

1696. Veneer-grafting.

Writing of the propagation of the tea plant under glass (which is suggestive for other plants in houses), Oliver says: "Seedling stocks may be grown in 4- or 5-inch pots for the reception of cions by the veneer method of grafting. To have the plants in perfect condition for working, it is necessary that they be grown from the seedling stage without a check, as the healthier the plant the better the chance of a successful union. Another important matter in this connection is that the stock plants should not be allowed to form matted roots in small pots; therefore, it will be found better to lift them from the nursery and put them in pots previous to the operation: or they may be grown and grafted while in garden flats. If this last-named method is chosen the plants should be situated far enough apart in the flats to be easily handled. If the grafting is performed while the stocks are in active growth, the union will take place more quickly than when the plants are in a dormant condition. The operation should be performed in the early part of spring. Fig. 1698 shows how the incision in the stem should be prepared. This should be made with a sharp knife and the cut at the deepest part should not be more than one-third of the diameter of the stem. The cion must be shaped at the base so that it will fit neatly into the place prepared for it on the stock. It should then be tied, and afterward a small quantity of sphagnum moss should be tied over the part where the stock and cion come together. Immediately after the operation is performed as above described, the plants should be placed in a close shaded propagating-frame and kept there until the union is effected; this will take place in a few weeks. The temperature of the frame should then be kept uniformly at 60° to 65° F. If a layer of moss be put under the pots and the contents of the frame syringed occasionally a favorably humid atmosphere will result. Where greenhouse accommodations are not available for the propagating-frame a hotbed may be built out-of-doors in a location where the sun will not have much effect in raising the temperature. From 6 to 9 inches of stable litter and leaves will provide ample heat during the spring. When it is found that the cions have made connection with the stocks, air should gradually be admitted to the frames. Shortly after this the tops of the stocks may be cut off close to the cions. Planting out may be deferred till the cions have made their first growth."



1697. Veneer-grafting.

1698. Veneer-grafting.

A form of veneer-graft is what is sometimes called the side-graft. It is shown in Fig. 1699 (adapted from Oliver).

Cion-budding.

When a woody cion is inserted underneath the bark in the side of the stock, as a shield-bud is inserted, the method is sometimes known as cion-budding. In describing a simple way of propagating the fig, Oliver writes: "This method consists of preparing the stock for the reception of the cion as in shield-budding. This is done by making a transverse cut through the bark

1699. Side-grafting.

¾ inch in length. From the middle of this incision another cut is made toward the main stem or root for fully an inch. The bark is then pried up as seen in Fig. 1700. Instead of inserting a single shield-bud, a small twig having one terminal and one or two lateral buds is used. The cion is prepared as follows: A long scarf is made at one side through the pith and a thin piece of the bark on the reverse side is removed. With

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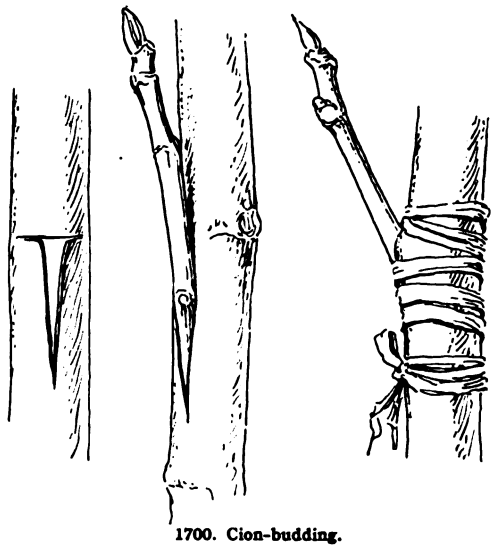
the long cut facing the stock the cion is pushed deeply into the place prepared for it, and is tied firmly with raffia. The corners of the bark of the stock are brought close to its own stem and bound firmly in that position. Melted grafting-wax should then be put on, or narrow strips of waxed cloth may be applied instead, to exclude air and moisture. If possible, the cions should be selected from branches not over ½ inch in diameter when they can be found of sufficient firmness of that thickness. Small lateral shoots having a terminal bud and only an inch or two in length and quite thin will unite by this method very easily. It is not necessary for the cions to be dormant, but they should be fully matured and the leaves cut off to about ½ inch from the buds. The bark slips readily from the time growth begins in spring, so that the operation may be performed at any period during late spring and summer. In the course of about two weeks after the operation is performed, if the cions remain fresh, the probabilities are that a union will have been effected. Part of the top of the stock may then be removed to induce the cion to start growth, and when it has made some headway the top of the stock may be cut off near the cion."



1700. Cion-budding.

Bark-grafting.

Bark-grafting (Fig. 1701) is an excellent method of grafting fairly large limbs, since it does not injure the stock so much as does the cleft-graft. The cions are cut thin and inserted between the bark and wood. The bark is securely bound to hold it tight, and the entire surface is waxed, as in cleft-grafting. This method is called crown-grafting by the French and English.

This method is useful when it is necessary to graft very large limbs, for the stub does not need to be split and several cions may be set. When large limbs are broken from apple and pear trees, the stub may be trimmed and several cions set around it, to hasten the healing and to afford strong shoots with which to renew the part.

Herbaceous grafting.

Pelargoniums, chrysanthemums, cacti, and other soft-wooded greenhouse plants are sometimes grafted for the novelty of having more than one variety growing on the same root. Probably most herbaceous plants can be grafted readily, with the exception of the endogens, which do not lend themselves to the operation, although there are examples in which grafting has been successful on them. To succeed with an herbaceous cion, it is necessary that the room be rather close and moist, so that evaporation will not be very rapid. One should endeavor to secure the general conditions that obtain in a good propagating-house. The temperature should be kept rather below the normal for that species until union has taken place. It is usually best to cover the union with moss or some other material to protect the wound and to check evaporation. Best results are secured when the cion is firm in texture, as also in the case of herbaceous cuttings. The kind of graft is of less importance, although it is customary to use the veneer-graft cions, since there is less injury to the stock and the outer surfaces are easily applied to each other. The cion ordinarily consists of one or two joints, and if the leaves are large, they are cut in two, as in the making of softwood cuttings.

1701. Bark-grafting.

Inarching, or grafting by approach.

In those cases in which union takes place with much difficulty, it is possible to effect the conjunction by allowing the cion to grow fast to the stock before it is severed from its own roots. The plant which it is desired to have grow on the stock is bent over to the stock, the surfaces of the two are exposed so that the cambiums may be pressed close together, and the two are then bound until union takes place. In some cases a tongue is made in both the cion and the stock, much as in whip-grafting, so that the surface of contact is greater and the parts are held together more securely. When the cion has become thoroughly established on the stock, the cion is severed from its own root and the top of the stock is cut off. This inarching or grafting by approach is also used in the greenhouse when it is desired to transfer the whole top or the whole branch of one plant to another. The illustration (Fig. 1702) shows such a case. Inarching is not much employed in this country in a commercial way.

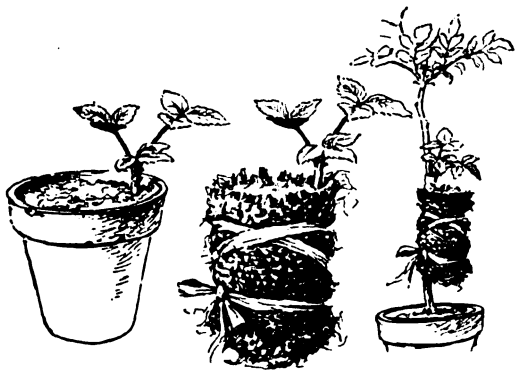
Inarching is sometimes employed to unite two branches into one for the purpose of making a specimen fruit grow larger. If, for example, a twig of an apple tree is inarched into a limb just back of a fruit, the extra food-supply may cause that fruit to grow larger, and a finer specimen may be secured. This use of the graft is employed only for the purpose of securing extra-fine specimens for exhibition or other purposes.

1702. Inarching the branches of two plants.

The seedling-inarch has recently been described in detail by Oliver (Bull. No. 202, Bur. Pl. Ind., U. S. Dept. Agric.). Such difficult subjects as the mangosteen, litchi and mango respond readily to this method. The idea is to inarch a very young seedling on an older stock, thereby saving time and securing more wood for further propagation. "Seedlings raised from seeds of new and rare trees, shrubs, and vines may be induced to grow very quickly if used as cions when a few

weeks old by inarching to strong-growing plants of other species of the same genus or in some cases on species of other genera of the same family. This has been done recently with such plants as chestnuts, walnuts, hawthorns, oaks, and many others. It is not necessarily done for the purpose of hastening the flowering or the fruiting of new plants, but to give quickly an abundance of material for propagation by budding or grafting when the new material is assumed to be valuable. If a hardwood seedling of hybrid origin is tied to a large stock and they fail to unite, there is little or no danger of losing the seedling, provided its roots are kept damp during the period of making the attempt. If the inarch is not successful, the seedling can be repotted and grown in the usual way."

In Fig. 1703 is shown the method of seedling-inarch. A rose seedling is grown near the side of a pot, it having



1703. Seedling-inarch of the rose.

been pricked off into a 2-inch pot shortly after the cotyledons are developed; it is next shown, after two or three weeks' growth, removed from the pot and tied in a cloth to facilitate handling, a little fresh soil being held in place by the covering; the ball is then secured to the stock, and the seedling is inarched by chamfering the surfaces in contact. When union is complete, the root of the seedling is removed.

Literature.

For further discussion of the whole subject of grafting, the reader is referred to current works on fruit-growing; also to the two American special books on the subject—Fuller's "Propagation of Plants" and Bailey's "Nursery-Book." In English, Baltet's "Budding and Grafting" is standard. It is an English version of "L'Art de Greffer." L. H. B.

GRAHÀMIA (Robert Graham, Scotch botanist, died 1845). Two genera have been made of this name. The accepted one is of the Portulacaceæ, comprising one species (*G. bracteata*, Gill.) of extra-tropical South America; this plant is not recorded in cultivation. The other Grahamia (of Sprengel) is now referred to Cephalophora; and Cephalophora is by Hoffmann (Engler & Prantl, Pflanzenfamilien, iv:5) included in Helenium. Of this Grahamia, *G. aromatica* is offered abroad; it is accounted for under *Helenium*.

GRAMMÁNGIS (Greek, *gramma;* perhaps referring to the markings of the flowers). *Orchidàceæ*, tribe *Vándeæ*. Epiphytic orchids grown in greenhouses.

Pseudobulbs short and thick, with foliage-lvs. only at their summit, hence not inclosed in the lf.-sheaths: fl.-clusters from the base, many-fld., pendulous; fls. not spurred; middle sepals strongly concave, lateral sepals somewhat sac-shaped at base, free, spreading; petals ascending, somewhat different in form and color; lip 3-lobed, with erect lateral lobes and recurved middle lobe; column slender, winged.—Species about 4, of Madagascar and Java. Nearest Cymbidium, differing chiefly in having the foliage-lvs. only at the end of the pseudobulb, and the rostellum crescent-shaped (in Cymbidium it is triangular). From Grammatophyllum (which see), Grammangis differs in the attachment of its pollen-masses and in the position of its foliage-lvs. Best cult. in baskets hung near the glass, where the light is most intense. The plants can also be grown successfully in pots placed near the glass, or fastened to blocks, but in the latter case they must be given more water.

Éllisii, Reichb. f. (*Grammatophýllum Éllisii*, Lindl.). Pseudobulbs 7–11 in. long, each bearing 5–6 lvs.: lvs. 1½–2 ft. long: sepals yellow, elegantly marked with dark transverse lines; petals and lip pale pink, the latter with a strong mid-nerve. Summer. Madagascar. B.M. 5179. C.O. 2.

G. Hùttonii, Benth. & Hook. (Cymbidium Huttonii, Hook. f.). Pseudobulbs of a single internode, 3–5 in. long, elongated, obovoid, green: lvs. in pairs, 6–8 in. long, 2–2½ in. wide, dark green, coriaceous: raceme about 10-fld., drooping; sepals obovate, recurved, light brown outside, streaked transversely inside with chocolate-color; lip greenish, with chocolate stripes. June. Java. B.M. 5676. O.R. 14:153. G.M. 48:467. G.C. III. 38:63.

T. H. KEARNEY.

GRAMMÁNTHES (Greek, *letter-flower;* the petals of the full-colored varieties have a darker mark like a letter V, whence also the name of the synonymous genus *Vauanthes*). *Crassulàceæ*. One small very variable half-hardy, succulent annual, with thick fleshy leaves and yellow flowers, growing about 6 inches high and is used for edgings, baskets and pots.

Erect, forking: calyx bell-shaped, semi-5-fld.; corolla-tube as long as the calyx; limb 5–6-lobed: carpels 5–6, many-ovuled, with awl-shaped styles: scales minute, or evanescent: follicles many-seeded. In sandy ground in the western part of the Cape region, S. Afr.

dichótoma, DC. (*G. gentianòides*, DC.). Glabrous, somewhat glaucous: branches forking: sts. rigid, filiform: lvs. opposite, distant, oblong, ovate or nearly linear: fls. orange, yellow, or creamy white, and marked as above described. F.S. 5:518. Var. **vèra**, (Harv.), has lvs. ovate-oblong: limb of corolla ovate-oblong, a third longer than the stamens. Var. **chloræflòra**, (Harv.), has lvs. oblong or linear: fls. a little larger; limb of corolla ovate-lanceolate, twice as long as the stamens. B.M. 4607, 6401. There are other named forms. Some of them are very depauperate in their native region, some of them only 1–2 in. high. WILHELM MILLER.

GRAMMATOCÁRPUS: *Scyphanthus.*

GRAMMATOPHŸLLUM (Greek, *gramma*, a line or streak, and *phyllon*, leaf; probably referring to the parallel leaf-veins). *Orchidàceæ*, tribe *Vándeæ*. A group of perhaps 8 or 9 epiphytic species, of which about half are well-defined, inhabiting the islands from Madagascar to the Philippines and New Guinea. The genus includes some of the largest and showiest of cultivated orchids.

Roots numerous: sts. or pseudobulbs many-lvd.: lvs. long, ribbon-shaped, thick, evergreen: racemes long-stalked, loosely many-fld., springing from near the base of the pseudobulb; fls. large, not obviously spurred; sepals and petals nearly equal, spreading; lip comparatively small, with margin entirely free, 3-lobed, with erect lateral lobes; column slender. Allied genera are Grammangis and Cymbidium, from both of which Grammatophyllum differs in having the pollen masses each borne upon an appendage of the stalk, while in the two related genera they are attached to a common stalk without special appendages.

The few species in cultivation are such infrequent bloomers that the flowering of a fine example is something of an event. They are propagated from pieces of the pseudobulbs. The plants are best grown in good-

sized and well-drained pots filled with peat, and need considerable water while actively growing. They should be allowed to rest occasionally. Season of bloom and further cultural details with each species.

A. *Pseudobulbs very long, comparatively slender.*

speciòsum, Blume (*G. Sanderiànum*, Hort.). LETTER PLANT. Fig. 1704. Pseudobulbs 6–10 ft. long, slender, flexuous: lvs. 2-ranked, 1–2 ft. long: fl.-clusters open, sometimes 6 ft. long from the base of the stalk; fls. numerous, 6 in. diam., clear yellow, spotted with deep red purple. Winter. Malayan region, notably Java. G.C. III. 7:297; 13:1; 22:145, 147; 33:391; 40:86; 42:169, 170. B.M. 5157.—This magnificent plant, one of the very largest of its family, has been well-named the "queen of orchids." A huge individual growing on a tree in the open at the Botanical Garden of Buitenzorg, Java, has the following dimensions: diam. of whole plant, 18 ft.; collar about the trunk of the tree formed by the closely interwoven roots, 7½ ft. diam., 2½ ft. thick, and over 3 ft. high; fl.-clusters (appearing at the same time) 50–60, each 2 ft. or more in length and bearing 70–100 fls. And it must be remembered that this huge plant is an epiphyte! Temperature, especially soil temperature, should be carefully regulated in growing this plant. Owing to the brighter light, it does better in American than in European hothouses.

1704. Grammatophyllum speciosum.

AA. *Pseudobulbs comparatively short and thick, leafy only at summit.*

B. *Fls. greenish or yellowish, spotted with brown.*

Fenzliànum, Reichb. f. (*G. Measuresiànum*, Hort.). Lvs. 4–6: fl.-clusters sometimes 15 at one time, each over 5 ft. long and containing over 60 fls., sepals and petals narrow, greenish yellow, tipped and spotted with brown; lip streaked with purple. April. Isl. of Amboina, Philippine Isls.(?). J.H. III. 29:123. G.M. 34:334. Var. **Measuresiànum,** Hort. (*G. Measuresiànum*, Hort.). Fls. larger and brighter; sepals and petals emerald-green, marked with brown-purple. G.W. 2, p. 73.

Rumphiànum, Miq. (*C. Guilélmi II*, Kränzl.). Pseudobulbs 6–8 in. long, ovoid or fusiform: lvs. 1–2 ft. long: raceme nodding or hanging, 3–4 ft. long from the base of the stalk; fls. often 30–35, 3 in. diam., green outside, green blotched with brown-purple within; sepals and petals similar; lip purple-veined, downy. Molucca Isls., Borneo, New Guinea, and the Philippines(?). B.M. 7507. C.O. 1.—A large, showy species.

BB. *Fls. brown, streaked with green.*

multiflòrum, Lindl. Lvs. 3–4: fl.-clusters nearly 2 ft. long. Summer. Philippine Isls. P.M. 6:217.—This very desirable species has not yet found its way into American trade. It is easily grown, either in a pot filled with a well-drained "compost of heath soil and pots-herds," or merely fastened to copper wire and hung from the roof.

G. Éllisii, Lindl.=Grammangis Ellisii.—*G. indeterminàle*, Hort. =(?).—*G. lévictum*, Hort.=(?).

T. H. KEARNEY.
GEORGE V. NASH.†

GRAPE. Plants of the genus Vitis, and the berries thereof, abundantly grown for fruit.

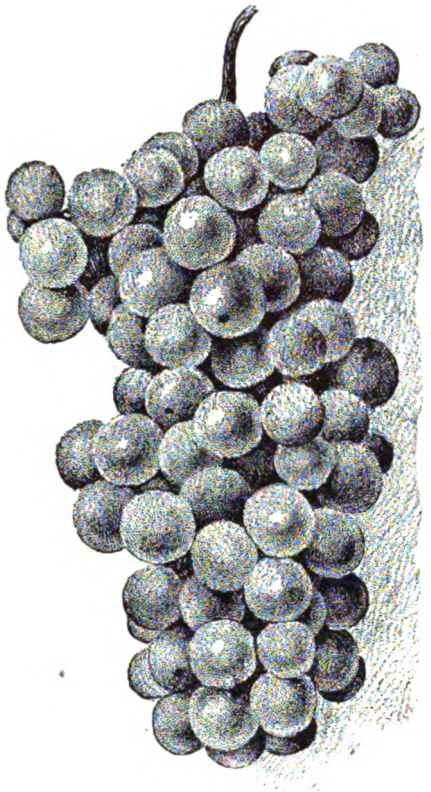
The grape is one of the oldest of domesticated fruits. It is probable that wine was made from it before the plant was brought into cultivation. It seems to have been cultivated at the dawn of history. Its product was apparently no rarity in Noah's time.

The grape of history is the Old World *Vitis vinifera*, the "wine-bearing Vitis," probably native to Asia. The paramount use of the grape always has been the production of wine. A secondary value is the production of raisins; and another is fruit for the dessert and for culinary uses. Great efforts were made to introduce the cultivation of the European grape into the American colonies, but they resulted in failure. It was not until the latter part of the last century that the chief causes of this failure became known: the depredations of the phylloxera and mildew,—and even then the causes were discovered largely because these American parasites had made incursions into the vineyards of Europe. In the meantime, one or two of the native species of Vitis had been ameliorated, and American viticulture had become established on a unique and indigenous basis, and the fruits are grown to eat rather than to drink. So fully did these early American ventures follow European customs that the grapes were usually planted on terraced slopes, as they are on the Rhine and about the continental lakes. Those early experiments finally failed because of the black-rot.

North America is richest in species of Vitis (see the article *Vitis*). These species range from ocean to ocean and from the British possessions to the tropics. The species that has been most improved is *Vitis Labrusca* of the Atlantic slope, although it seems to possess less native merit than some of the southwestern species-

1705. The Labrusca or Fox-Grape type. Niagara (at left); Brighton.

types. Of this species are the Concord and Catawba types (Fig. 1705). To some extent it has been hybridized with *Vitis vinifera* (as in Agawam, Lindley, Barry, and others of E. S. Rogers' varieties), and with native species. Already a number of the popular varieties



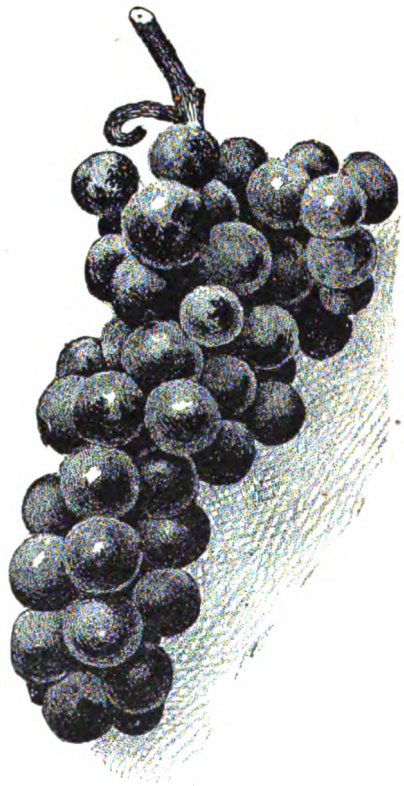
1706. Horticultural product of Vitis æstivalis—Onderdonk, seedling of Herbemont. (×⅝)

represent such wide departures that they cannot be referred positively to any species. Of these, Delaware and Isabella are examples. The second most important species, in point of amelioration, is *Vitis æstivalis*, from which several of the best wine grapes have sprung (Fig. 1706). The post-oak grape (*Vitis Lincecumii*, or *V. æstivalis* var *Lincecumii*) of the Southwest, is one of the most promising species, and already has given excellent results in hybridization. See Fig. 1707. The Muscadine (*V. rotundifolia*) of the South has given the Scuppernong and a few less known forms. (Fig. 1708.) Beyond these species, there are none which has given varieties of great commercial importance, although considerable has been done in improving them. Some of the best of the wild species are practically untouched; there is only a comparatively small area of our great country which has yet developed large interests in grape-growing: the grape-types of a century hence, therefore, may be expected to be very unlike the present-day varieties. For an extended sketch of American grape history, see Bailey, "Evolution of Our Native Fruits" (1898). The American grape literature is voluminous. More than fifty authors have written on the subject. Yet there is very little of this writing which catches the actual spirit of American grape-growing; this fact, together with the technicality and diversity of the subject itself, makes it seem wise to devote considerable space to the grape in this Cyclopedia.

While the native grape was being ameliorated in the East, the Old World *Vitis vinifera* was becoming established on the Pacific slope. In fact, *Vitis vinifera* has there run wild. The phylloxera and mildew are not native there, and the climate better suits the species. The Pacific coast viticulture, therefore, is of the Old World kind.

We now know that the phylloxera or root-louse can be evaded when the vinifera grape is grafted on native or resistant stocks, and the mildew can be combated by fungicides. Of late years, therefore, new efforts have been made to grow the wine grape in the eastern states, and in the southern latitudes some of these experiments promised well for a time. However, so great attention is required to produce a satisfactory product as to discourage the growing of vinifera varieties in the open in the East. Vinifera types will always be special grapes in the East, adapted only to particular conditions, for it is not to be expected that they can compete with the more easily grown and cosmopolitan varieties of the native species. Under glass, however, the vinifera varieties thrive; and a special discussion is given herewith (page 1388) to this branch of the subject.

The greatest development of the native grape industry has taken place in Ontario, New York, and Ohio, bordering lakes and large streams. These areas are the lower Hudson River Valley; the region of the central-western New York lakes; the Lake Erie region of New York, Pennsylvania and Ohio; the so-called peninsular region of Ontario lying between Lake Erie and Lake Ontario. There are also important grape interests in Michigan, and other northern parts. There is considerable interest in grape-culture in the cooler parts of Georgia and Alabama, and there are enlarging areas in the country extending from the Ozark region southward. Nearly all the country, excepting the northernmost parts, raises grapes, but in most cases the growing of them cannot be said to be extensive enough to be called an industry. Although the grape sections of the North follow the water areas where the land is often steep, all grape-growers prefer nearly level land. The Old World plantations are largely on very steep lands; such lands, by virtue of their warmth and drainage, are thought to give an extra quality of wine. These ideas were brought to this country, and many of our early vineyards were planted on terraced slopes. But we grow grapes for a different purpose from the Europeans, and land is cheap and labor is dear. Old World



1707. Hybrid of Vitis Lincecumii and a fox-grape derivative—Husmann. (×⅝)

methods cannot be followed in the American commercial plantations.

The cosmopolitan American grape, of the native type, is the Concord, which originated with Ephraim W. Bull, of Concord, Massachusetts (Fig. 1709.) Other varieties of leading prominence in the North are Catawba, Delaware, Niagara, Worden.

1708. The Muscadine grape.—Vitis rotundifolia.

The ideal bunch of grapes is of medium size for the variety, compact, uniformly developed and ripened throughout, containing no small or diseased berries, and with the bloom intact. A very dense or crowded cluster is not the most desirable, for all the berries cannot develop fully, and the cluster is not easily handled when the fruit is eaten. Fig. 1710 shows a cluster of good shape and compactness: Fig. 1711 is too broad and irregular; Figs. 1712, 1713, are rather too dense and compact.

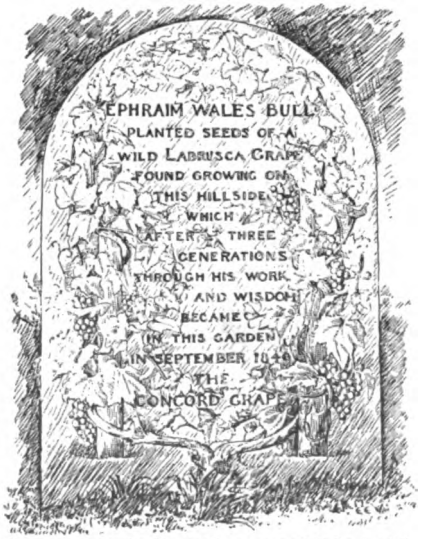
The American grape is essentially a dessert fruit. It is eaten from the hand. There are several manufactured products, but, with the exception of wine, they have been of minor importance until recent years, although there are many large wine-cellars in New York and Ohio, and the product is of excellent quality. Unfermented grape juice is now manufactured in great quantities and has become an important article of commerce (see Cyclo. Amer. Agric. Vol. II, p. 178). The lack of secondary domestic uses of the grape has been one reason for the very serious gluts in the markets. However, one year with another, the profit on a good vineyard may be expected to exceed that on the staple farm crops.

Pruning and training.

A grape-vine is pruned in order to reduce the amount of wood (that is, to thin or to limit the amount of fruit), and to keep the plant within manageable shape and bounds. A vine is trained in order to keep it off the ground, out of the way of the workmen, and so to arrange the fruit that it will be well exposed to light and air. In order to understand the pruning of grapes, the operator must fully grasp this principle: *Fruit is borne on wood of the present season, which arises from wood of the previous season.* To illustrate: A growing shoot, or cane of 1914, makes buds. In 1915 a shoot arises from each bud; and near the base of this shoot the grapes are borne (one to four clusters on each). This is shown in Fig. 1714. The 1914 shoot is shown at the top. The 1915 shoot bears four clusters of grapes. While every bud on the 1914 shoot may produce shoots or canes in 1915, only the strongest of these new shoots will bear fruit. The skilled grape-grower can tell by the looks of his cane (as he prunes it, in winter) which buds will give rise to the grape-producing wood the following season. The larger and stronger buds usually give best results; but if the cane itself is very big and stout, or if it is very weak and slender, he does not expect good results from any of its buds. A hard well-ripened cane the diameter of a man's little finger is the ideal size.

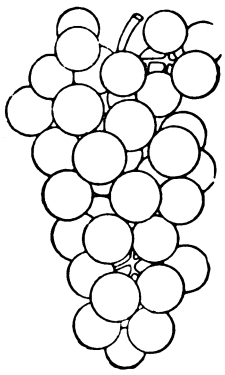
The second principle to be mastered is this: *A vine should bear only a limited number of clusters,*—say from thirty to eighty. A shoot bears clusters near its base: beyond these clusters the shoot grows into a long, leafy cane. An average of two clusters may be reckoned to a shoot. If the vine is strong enough to bear sixty clusters, thirty good buds must be left at the annual pruning. How much a vine should be allowed to bear will depend on the variety, distance apart of the vines, strength of the soil, age of the vine, system of pruning, and the ideals of the grower. The Concord is one of the strongest and most productive of grapes. Twelve to fifteen pounds is a fair crop for a mature vine; twenty pounds is a heavy crop; twenty-five pounds is a very heavy crop. An average cluster of Concord will weigh one-fourth to one-third of a pound. The vine may be expected to carry from thirty to sixty clusters; and the annual pruning will leave from fifteen to thirty buds.

Since the bearing wood springs from new canes, it follows that the fruit of the grape is each year borne farther from the main trunk of the vine. Observe that the fruit of wild vines is borne beyond reach when they climb over thickets and trees. It is a prime object of the grape-grower to obviate this difficulty. The third principle in the pruning of grape-vines is this: *The bearing wood should be kept near the original trunk or head of the vine.* When one cane is sending out fruit-bearing shoots, another shoot is taken out from near the main trunk or head to furnish fruit-bearing shoots

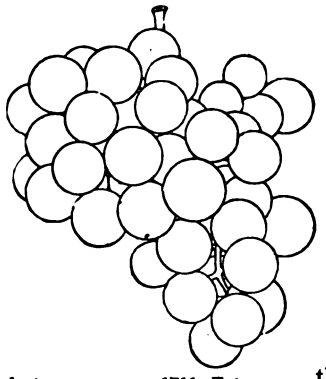


1709. Monument to the Concord grape and Ephraim W. Bull. Erected by the town of Concord.

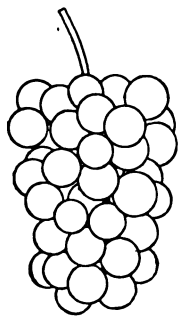
for the next year; and the other or older cane is entirely cut away after the fruit is off. That is, the wood is constantly renewed; and the new shoots which are to give bearing wood the following year are called *renewals.* Some systems of grape-training renew back to the root every year or two, and these have been called renewal systems; but every system of grape-pruning must practise renewal in one way or another.



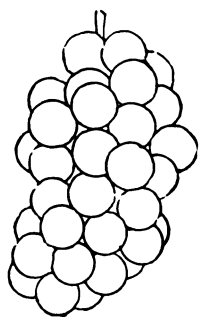
1710. Grein Golden. A good grape cluster.



1711. Eaton.



1712. Moore Early.



1713. Massasoit.

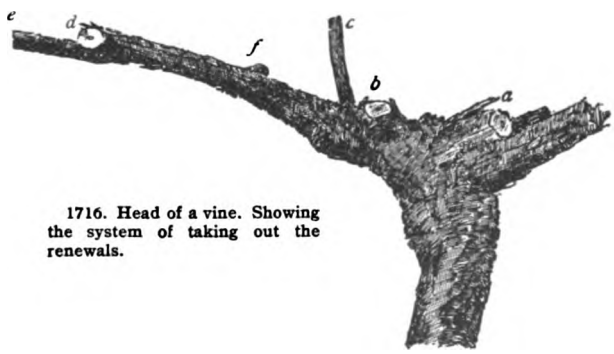
An old system of renewal was by means of spurs. Fig. 1715 illustrates this. The horizontal part is a permanent arm or branch. We will suppose that it grew in 1912. In 1913 a shoot grew upward. It bore two or three clusters of fruit. In autumn it was cut back to *a*, two buds being left to supply the shoots of the succeeding year. This short branch is now called a *spur*. Only one shoot was wanted for the next year, but two buds were left in case one should be injured. In 1914, a branch grew from one of these buds: it bore fruit: in the fall it was cut back to *b*. In 1915 a shoot will grow from one of the buds, *c*. Thus the spur elongates year by year, becoming a forking, complicated, stubby branch. After a few years it may become weak: the grower sees this, and if a new shoot should start from the main arm near the base of the spur, he encourages it and cuts off all of the old spur: thus he renews back again to the main vine. Shoots from adventitious or secondary buds are likely to spring from the main arm or the spur at any time. These are usually weak and are removed, but now and then a strong one arises. Spur-pruning is now rarely used except in grapes grown on arbors or under glass, in which cases it is necessary to have a long, permanent trunk. On arbors it is best to carry one arm or trunk from each root to the top of the framework. Each year the lateral canes are cut back to spurs of two or three buds. The pruning of glasshouse grapes is discussed under *Grapes under glass* (page 1389).

The current systems of pruning renew to a head—or to the main trunk—each year. The trunk is carried up to the desired height—to one of the wires of the trellis—and one or more canes are taken out from its top each year. The object is to keep the bearing wood near the main trunk and to obviate the use of spurs. This type of pruning is illustrated in Fig. 1716. This engraving shows the head of a vine seven years old, and on which two canes are allowed to remain after each annual pruning. The part extending from *b* to *f* and *d* is the base of the bearing cane of 1914. In the winter of 1914–15, this cane is cut off at *d*, and the new cane, *e*, is left to make the bearing wood of 1915. Another cane arose from *f*, but it was too weak to leave for fruiting. It was, therefore, cut away. The old stub, *b*, *f*, *d*, will be cut away a year hence, in the winter of 1915–16. In the meantime, a renewal cane will have grown from the stub *c*, which is left for that purpose, and the old cane, *b d*, will be cut off just beyond it, between *c* and *f*. In this way, the bearing wood is kept close to the head of the vine. The wound *a* shows where an old stub was cut away this winter, 1914–15, while *b* shows where one was cut off the previous winter. A scar on the back of the head, which does not show in the illustration, marks the spot where a stub was cut away two years ago, in the winter of 1912–13. This method of pruning can be kept up almost indefinitely, and if care is exercised in keeping the stubs short, the head will not enlarge out of proportion to the growth of the stock or trunk.

1715. Pruning to a spur.

Two common styles of training are in use in the

1714. Fruit-bearing of the grape.



1716. Head of a vine. Showing the system of taking out the renewals.

northern states, but each of them practises essentially the system of renewals described in the last paragraph. One style of training carries the trunk only to the lowest wire of the trellis. The canes—usually two in number—are tied horizontally on the bottom wire, and the bearing shoots are tied, as they grow, to the two wires above

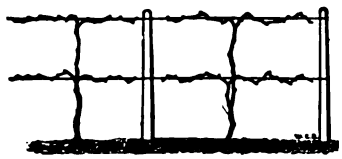
1717. Upright system of grape-training.

At the winter pruning, all the top will be cut away except two canes near the center; these two will be laid down in opposite directions on the bottom wire for the next season's fruiting.

(Fig. 1717). This is an *upright system*. The other style carries the trunk to the top wire. The canes are tied on the top wire, and the bearing shoots hang. This is the *drooping* or *Kniffin system*. If the shoots run out on the top wire by clinging to it by tendrils, they are torn loose, so that they will hang: this is a very necessary practice. There is controversy as to the comparative merits of these systems, which proves that each has merit. It is probable that the upright system is better for the slender or shorter varieties, as Delaware, and also for those whose shoots stand erect, as Catawba. The Kniffin has distinct merit for strong-growing varieties, as Concord; it is also cheaper, since it requires no summer tying. This system is well illustrated (as given by E. W. Williams in "Garden and Forest," I: 461) in Figs. 1718–1720.

One- or two-year-old vines are planted either in the fall or early spring. At planting, the vine is cut back to three or four buds, and the roots are shortened (Fig. 1724). If all buds start, the strongest one or two may be allowed to grow. The canes arising from this bud should be staked and allowed to grow through the season; or in large plantations the first-year canes may be allowed to lie on the ground. The second year this cane should be cut back to the same number of eyes as the first year. After growth begins in the second spring, one of the strongest shoots should be allowed to remain. This cane may be grown to a single stake through the second summer. At the end of the second year the cane may be cut back to the bottom wire of the trellis, if upright training is to be employed. The cane may be strong enough at this time to be made the permanent trunk of the Kniffin training, but in most cases the trunk is not carried to the top wire until the third year.

The main pruning is performed when the vine is dormant. The ideal time is January and February in the North, although the work is often begun in November if the area is large. Pruning in spring causes the vine to bleed, but bleeding is not injurious. But late pruning interferes with tillage, and the buds are likely to be injured after they are swollen. Summer pruning is now practised only to the extent of pulling out suckers and weak shoots, and even this is not always done. Heading-in the vine in summer is likely to start side growths, which are useless and troublesome.

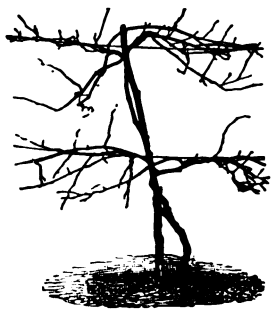


1718. The Kniffin system of grape-training.

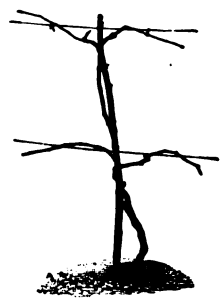
Propagation.

The grape grows readily from seeds, which may be kept over winter and germinated in the house early in the spring. They may even be planted in beds in the open, but the proportion of failures will be greater. Seeds produce new varieties, and they are used only in an experimental way.

The commercial propagation of grapes is accomplished by means of hardwood cuttings. These cuttings are taken in the winter from the trimmings of vineyards. In all ordinary cases they are made of two or three buds' length, preferably three (Fig. 1721). They are cut as soon as the canes are trimmed, tied in small bundles, and these bundles are then buried half their depth in damp sand in a cool cellar. By spring the cuttings will be more or less callused. The cuttings are planted in the open on the approach of warm weather. A loose loamy soil is chosen, and it is well and deeply prepared. The cuttings are inserted until only the upper bud stands at the surface of the ground. These cuttings are placed 6 to 8 inches apart in rows, and the rows are far enough apart to allow of horse cultivation. These cuttings may give plants large enough for sale the following autumn; but it is usually preferred to let the plants grow two years before they are put upon the market. In such cases it is customary in many of the best nurseries, to transplant at the end of the first season. When wood is scarce, the canes are sometimes cut to single eyes. In this case about an inch of wood is left on either side of the bud. Single-eye cuttings are nearly always started under glass, preferably on the greenhouse bench. If they are started in February, they will be large enough for transplanting



1719. The Kniffin vine before pruning.



1720. The vine after pruning.

in a well-prepared seed-bed very early in the spring. Greenwood cuttings are sometimes used in the summer with new and rare varieties, but they are not in general favor. In California, rooted vines of one year are preferred; and in soil in which cuttings root readily, they are sometimes planted directly in the vineyard.

The grape is easily grafted. Because of the flexible nature of the vine, however, it is customary to make the graft below the surface of the ground. An ordinary cleft-graft is usually employed. The whole vine is cut off 4 or 5 inches below the surface, and the graft is inserted in the same fashion as in apple or pear trees. The surface may then be waxed or covered with clay or other material, to keep the water out of the cleft, although if the earth is firmly packed around the graft and no water stands, the union may be perfectly satisfactory without any cover. (Figs. 1722, 1723.) Vines of any age may be grafted. It is important that the cions be perfectly dormant. These cions are taken and stored in the same way as cuttings. The grafting should be done very early in the spring, before the sap starts. Grafting may also be performed late in the spring, after all danger of bleeding is over; but, in that case, it is more difficult to keep the cions dormant, and

the growth is not likely to be so great the first season. Vineyards composed of unprofitable varieties may be changed to new varieties very readily by this means. Vinifera varieties can also be grafted on our common phylloxera-resistant stocks by the same method. Almost any method of grafting can be employed upon the grape-vine if the work is done beneath the surface.

1721. Common 3-bud cutting of grape.

Insects and diseases.

The grape is amenable to many insect and fungous attacks. The most serious difficulty is the phylloxera, which, however, is practically unknown as an injurious pest on the native grapes. On the vinifera varieties it is exceedingly serious, and it is working great devastation in many of the vineyards of the Old World and of the Pacific coast. The most practicable means of dealing with this pest is to graft the vinifera vines on native or resistant roots.

The mildew and black-rot are the most serious of the fungous enemies in the central and eastern parts of the continent. Both these diseases cause the berries to decay. They also attack the leaves, particularly the mildew, causing the leaves to fall and preventing the grapes from maturing. It is the mildew that has worked such havoc in European vineyards. The mildew is most serious on thin-leaved and smooth-leaved varieties, as the Delaware. It produces yellowish patches on the leaves, with frost-like colonies on the under sides. It causes the berries to decay with a gray and finally a brown rot, the berries usually remaining small and firm but not greatly wrinkled. The black-rot causes the berries to become very hard, dry and shriveled, and the epidermis is covered with minute pimples. (Fig. 1286, Vol. II.) The treatment for both these diseases is the same—spraying with bordeaux mixture. In regions in which the diseases have not been very prevalent, it is usually sufficient to begin the spraying after the fruit has begun to set, and to spray two or three times, as the case seems to require. When the diseases have been very prevalent, however, it may be well to begin before the buds swell in the spring. In infested vineyards, the foliage and diseased berries should be raked up and burned in the fall.

The anthracnose or scab (*Sphaceloma ampelinum*) is a very serious fungous disease. It is most apparent on the fruit, where it makes a hard, scabby patch. Its most serious work, however, occurs on the stems of the clusters and on the young growth, where it makes sunken, discolored areas, and where it interferes seriously with the growth of the parts. It is not so easily controlled as the mildew and the black-rot. Careful attention to pruning away all the diseased wood and burning it will help in controlling the disease. Before growth starts, spray the vines, trellis and posts with sulfate of iron solution. After the leaves open, use the bordeaux mixture.

In grape-houses the powdery mildew (*Uncinula spiralis*) often does much damage. It also occurs in the open vineyard, but it is usually not serious there. It appears as a very thin, dust-like covering on the leaves. It sometimes attacks the berries, causing them to remain small or to crack. This fungus lives on the surface, and is therefore readily controlled in grape-houses by dusting with flowers of sulfur or by the fumes of evaporated sulfur.

The oidium is the most prevalent fungous disease in California. It is controlled by dust-sprays of sulfur (page 1387).

Many other insects and diseases prey upon the grape, but those mentioned above are widespread and may be considered as perhaps the standard parasites. (See Vol II, pp. 1031, 1053.)

Literature.

The American book literature of the grape is nearly as large as that of all the tree-fruits combined. Probably 100 books, counting the various editions, have been published in North America since Adlum's volume in 1823 (see "Evolution of Our Native Fruits," pp. 117–126). The earlier books were founded largely on European practices. The leading current works are: "Bushberg's Descriptive Catalogue and Grape Growers' Manual;" Mitzky's "Our Native Grape;" Fuller's "Grape Culturist;" Husmann's "American Grape Growing and Wine Making." For the Pacific slope, Husmann's "Grape Culture and Wine Making in California," Wickson's "California Fruits," and Eisen's "Raisin Industry" are useful guides. Detailed discussions of pruning and methods of training are contained in "The Pruning-Book." A standard European monograph is Foëx's "Cours Complet de Viticulture." The recent standard American works are Munson's "Foundations of American Grape Culture," and Hedrick's "Grapes of New York," which are notable contributions to horticultural literature. L. H. B.

Grapes in the North (Canada).

Any section in which grapes will thrive without winter protection may be said to be a commercial section. For home use they are grown far north by covering with earth or litter during the winter. When the leaves are falling or have fallen in autumn, the vines are pruned—fan system, with the old stalks very close to the ground, and laid flat upon the earth. Here they are left under their straw or earthy covering until danger of frost is past, the following spring, when the covering is removed and the canes tied to the wires. But this is expensive and the method is not commercial.

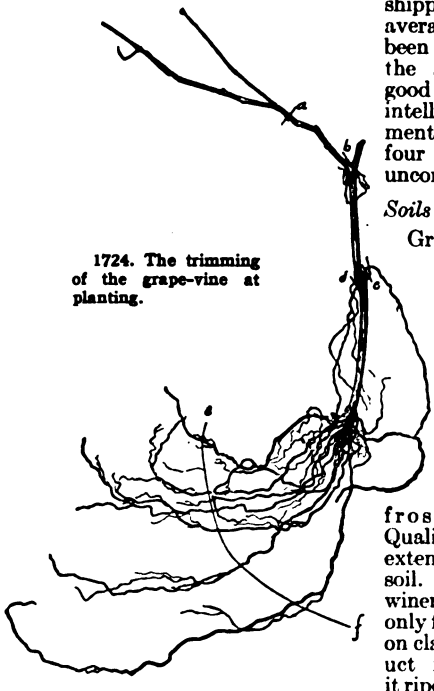
For market purposes, grapes are grown with one of two main objects in view: either for wine (sweet or fermented) or table and dessert purposes. The purpose determines the variety. Concords and varieties approaching it in type and quality are the choice for the former purpose, while for the latter the variety is determined by the season and the market demand. In the former case, also, the number of varieties is limited, while in the latter they are numerous, ranging from the earliest, Champion, to the latest, Vergennes, and intermediate varieties of all colors and grades.

1722. Cleft-grafting the grape.

1723. Cleft-grafting the grape.

Grapes, unlike peaches and cherries, are not subject to very great fluctuations in price and yield. They are comparatively steady in their returns, and, while never advertising themselves by enormous yields and profits, are ever pushing to the front in acreage, yield to the acre and importance. The acreage increase has been very rapid until now New York, the leading northern state of the United States, which thirty-five years ago had but a small acreage, today has more

than 70,000 acres, and Ontario, the leading province of the Dominion, has approximately 14,000 acres. The rapid increase has not been because of high prices, but rather steady average prices from $18 to $30 a ton, delivered at the winery, or an equal price f.o.b. the shipping-station. The average yield has not been over two tons to the acre, but, under good conditions, with intelligent management, an average of four to six tons is not uncommon.



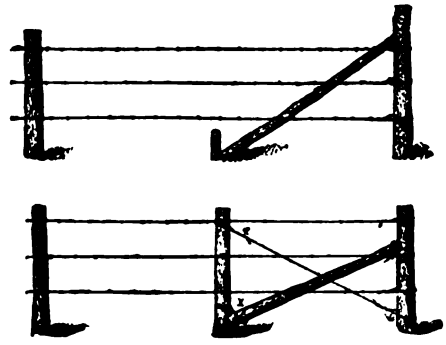
1724. The trimming of the grape-vine at planting.

Soils and location.

Grapes are grown on all types of soils, on many sites, in various locations. But the loams and clays with good drainage, the sites with good air-circulation, and the locations that are reasonably free from frost are preferred. Quality is to a large extent determined by soil. Some of the wineries will accept only fruit that is grown on clay soils. The product is more uniform, it ripens more regularly and the sugar-content is higher. Also some coöperative companies that are catering to a special trade, advise their members to plant only on heavy soils because the grapes are sweeter and of higher quality. The ideal soil, however, is the rich, deep, alluvial, easily drained loams that have taken centuries to build up from the washing of the hillsides toward the margins of the lakes and rivers.

The site is of importance for two reasons, those of air-circulation and sunlight, both of which serve the same purpose: to assist the grower in his fight against disease. Disease can live only in conditions that favor it, and light and air are its hereditary enemies. Site is also often discussed with reference to early bud-development and late spring frosts, but its importance has been overdrawn. The number of vineyards injured annually in this manner in the commercial districts is very small.

Location (and by that is here meant the situation of a district) is of extreme importance. In the Niagara Peninsula, Ontario,—the largest grape-growing center in Canada,—the aspect is north, with a hill in the rear, and facing the waters of Lake Ontario. Here the crop naturally varies, but it never fails. The same applies to the best parts of New York State, the commercial sections of the one being but continuations of the other. The favored spots in Ontario are not on the shore of the lake but rather just below the escarpment where the water has less influence. Grapes on the shore sometimes fail to ripen well and the quality is consequently inferior. Because of this, many vineyards on the shore have been removed in late years, while the interior plantings have largely increased. If the volume of water were smaller, the influence would be sufficient only for frost-protection; but, where it is so large, it retards early development. The water influence is striking, as the fruits (peaches, for example) ripen from six to ten days later on the shore than two to four miles inland.



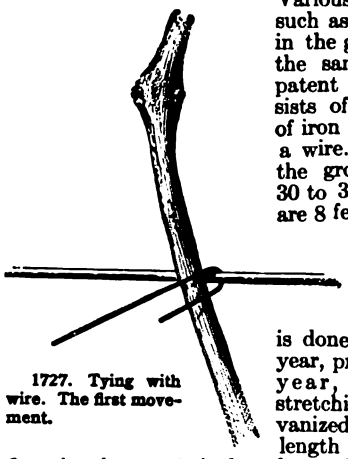
1726. Illustrating the bracing of the end post in a fence or trellis.

Stock and pruning.

One-year-old plants are the choice for planting. These should be well grown and healthy. Two-year-old plants are often only one-year culls. The plants are set as early in the spring as possible on land that has been previously prepared by growing a cultivated crop. Plants set in sod or on unprepared land do not thrive, and poor growth the first year is not made up two years later. The stock is heeled-in as soon as it comes from the nursery, but is left heeled-in only until the ground is ready for planting, which is as early as possible. When planting, time is saved by plowing a furrow, sometimes by throwing out two furrows, one each way. A man with a spade deepens this, or loosens the soil in the bottom, and then packs it again firmly around the roots. Before planting, all broken and damaged roots are cut away and sometimes the healthy ones are cut back. (Fig. 1724.) The tops are cut back to two to four buds. Distances of planting vary greatly, depending on the variety and the ideas of the planter. The popular distances are 7 by 10 feet to 8 by 10 feet for the small-growing varieties, to 9 by 11 feet for the larger-growing varieties. A few of the small-growing varieties are planted 6 by 9 feet, but this is exceptional. The first year the vines are allowed to

1725. A vineyard in its first summer.

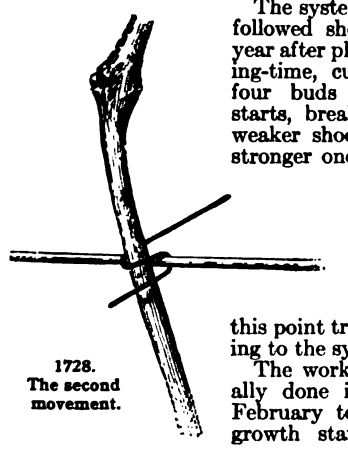
run as they will. (Fig. 1725.) The posting is done the second or third year. This consists of driving posts sharpened at one end or digging holes and setting them about 21 to 27 feet apart. One post is set for each three vines. The end posts are either braced the same as ordinary fence-posts or anchored. (Fig. 1726.)



1727. Tying with wire. The first movement.

Various anchors are used, such as large stones buried in the ground, cement used the same as stones, or a patent anchor which consists of a V-shaped piece of iron to which is attached a wire. This is driven in the ground to a depth of 30 to 36 inches. The posts are 8 feet in length, usually cedar or chestnut, and cost from 15 to 25 cents each—an average of 20 cents. The wiring is done the second or third year, preferably the second year, and consists of stretching two No. 9 galvanized wires the entire length of the row. The first is about 30 inches from the ground and the second about 30 inches above this. Some use three wires, but two are more popular. The wires slacken easily and the posts heave some every winter. This must be corrected regularly before tying the grapes. Drive the posts to place with a ten- or twelve-pound mallet and tighten the wire by turning the patent stretcher on the anchored posts. When putting the wire on the posts and tying the vines to the wire always place them on the windward side, as they are less likely to be blown down and damaged. The vines may be secured with raffia or with wire. (Figs. 1727–1730.)

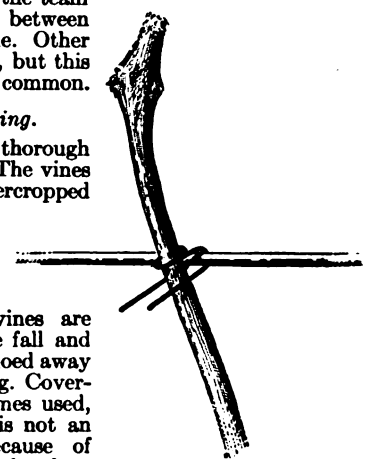
Pruning systems are many and varied, and the advocates of each system claim for their ideal special merits. Kniffin, Improved Kniffin, Fan, Arm and High Renewal systems are all used to some extent, but the Fan and Improved Kniffin are the most popular. Many growers believe that it is impossible to prune to a definite system, but by others this is not found to be the case. Many leave the necessary number of strong healthy canes and tie them up as best they can space them on the wires. From twenty-eight to forty buds is the popular number to leave, and the ideal of the grower is the only guide on which canes to leave these buds. The preference is usually given to the strong quality-looking canes on which the buds are close together.



1728. The second movement.

The system of pruning to be followed should be started one year after planting. As at planting-time, cut back to three or four buds and after growth starts, break or rub off the weaker shoots. This gives the stronger ones an opportunity to thrive. Tie to the lower wire. The second season it may be advisable to cut back similarly, especially if the growth has been weak. From this point train the vines according to the system to be followed.

The work of pruning is usually done in the spring, from February to April, before any growth starts. If growth has started, the vines will bleed. The brush is gathered, in most cases, with a pole about 11 or 12 feet long, 3½ inches in diameter at one end and tapering to about 1½ to 2 inches. This must be of strong material that will bend without breaking. A chain is attached from 24 inches to 36 inches from the large end, and as it is drawn by the team the brush collects between the chain and pole. Other methods are used, but this is by far the most common.



1729. The third movement.

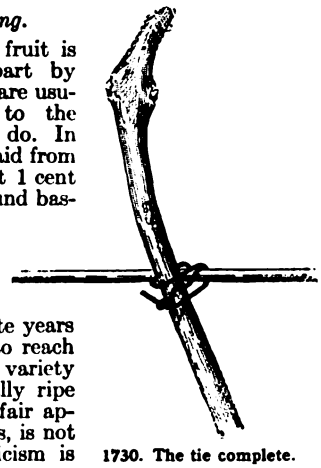
Tillage and fertilizing.

Cultivation is thorough for best results. The vines are sometimes intercropped with cultivated crops the first year after planting, but later they require all the care. The vines are plowed up in the fall and disced and grape-hoed away the following spring. Cover-crops are sometimes used, but the practice is not an extensive one because of damp conditions for harvesting in the fall. Cover-crops are sometimes not plowed under till the following spring. The tying is done by women and girls in early spring before the buds are so swollen that they are easily damaged. Many materials are used, but the most common are wire and a soft wool twine made for the purpose. The twine is most used, although the wire is very handy. The canes are spaced when tying, and thus held in place until the tendrils of the new shoots secure them to the wire.

Fertilizing is still done in a haphazard way. Some of the best men make a regular practice of mulching the roots with farmyard manure in the fall. Some apply no farmyard manure at all. The use of commercial fertilizer is still in the experimental stage. Its value is admitted but its use is not fully understood. On light and gravel soils some potash compounds are being used. On the deep alluvial soils some growers are using it in the form of wood-ashes rather than the prepared commercial product. Some bone-meal, at the rate of 300 to 600 pounds to the acre, is being used also. Some state profitable results from their methods; others think that with light applications of farmyard manure and thorough cultivation the commercial fertilizers are not required.

Harvesting and marketing.

The cutting of the fruit is done for the most part by women and girls, who are usually paid according to the amount of work they do. In some cases they are paid from $1 to $1.25 a day, but 1 cent for an eight- to ten-pound basket is more satisfactory. Cutting starts as soon as the earliest grapes are ready for the market. In Canada, Champions have of late years been the first variety to reach the wholesaler. This variety colors before it is really ripe and, though having a fair appearance in the baskets, is not really ripe. Sharp criticism is



1730. The tie complete.

leading the growers to be more cautious and to some extent drop the variety for the more satisfactory Campbell and Moore Early. These varieties are later, but please the purchaser. For wine purposes the fruit is left on the vines as long as possible so that it becomes fully matured. Grapes, unlike apples and especially pears, do not ripen off the vines and must be left until fully mature if the highest quality is expected, especially for dessert.

Of late years large acreages have been planted especially for the markets of the Canadian West. Coöperative associations have been organized to handle all varieties extending over the season; but, in the case of one large company, one variety only, Worden, is handled. This ripens before Concord and consequently brings a high price. The location of the vineyards of this particular company is ideal; the fruit is of good quality and ripens early and it seems that under those particular conditions the Worden is the most profitable grape to grow.

The forming of coöperative associations for the purpose of marketing the fruit has the distinct advantage of improved distribution. It has also cut down the handling expenses. Very few baskets, except special orders, are sent great distances by express. The coöperative associations have enabled the growers to secure car rates, and though prices have been comparatively low, even as low as 10 cents for an eight-pound basket, f.o.b. shipping station, the cheap and rapid methods of handling have made the industry profitable.

Returns.

Grapes, as grown at the present, might be considered a long-term investment with every prospect of regular dividends. The cost of planting, posting and early cultivation is comparatively high, but the vines bear early. Good crops are produced the third and fourth years after planting and the following year the vines should be in full bearing. The cost of planting and growing an acre of grapes to three years of age can only be estimated. Men, methods and conditions vary so much that no figures can be taken as absolute; but the figures and calculations serve as a guide and as such they are given here:

FIRST YEAR.

Land	$125 00
Fall preparation of land	3 00
Spring cultivating and marking furrows	1 50
Cost of 435 vines at 4 cents	17 40
Planting	3 00
Cultivating	3 00
Fall plowing	2 00
Total expenditure for first year	$154 90

SECOND YEAR.

Working soil in spring	$1 50
Cultivating	3 00
Pruning and tying	1 00
120 posts at 20 cents	24 00
120 posts (including digging and setting) at 5 cents a post	6 00
Staples, wire and wiring	22 00
Total	$57 50

THIRD YEAR.

Pruning	$1 50	
Tying	50	
Cultivating and plowing	5 50	
Fertilizing	8 00	
Spraying twice	1 00	
Average crop for third year 435 baskets an acre. 435 baskets at 12 cents		$52 20
Cost of 435 baskets at $34 a thousand	14 79	
Picking 435 baskets at 1 cent a basket	4 35	
Covering	1 00	
Delivery	75	
Total expenditure for third year	$37 39	
Total revenue		$52 20
Net revenue		$14 81

Total expenditure for first three years:		
First year	$154 90	
Second year	57 50	
Third year	37 39	
	$249 79	
Third year revenue		$52 20
Net expenditure for three years	$197 59	

FOURTH YEAR.

Pruning	$3 00	
Tying	2 25	
Gathering and burning brush	50	
Spraying	1 40	
Plowing and cultivating	5 50	
Fertilizing	8 00	
800 baskets at 12 cents		$96 00
Cost of 800 baskets at $34 a thousand	27 20	
Picking 800 baskets at 1 cent a basket	8 00	
Covering	2 00	
Delivering	1 00	
	$58 85	$96 00
Profit		$37 15

The late J. W. Spencer, in his article in Cyclopedia of American Horticulture, on "Grapes in the North," gave the following as submitted by A. B. Clothier, Silver Creek, N. Y.:

Plowing and marking an acre of land	$3 00
Number of plants, 8 x 9 feet, 605 cost	12 10
Cost of planting	1 50
Number of cultivations first season, seven; cost	7 00
Cost of cultivation second season	7 00
Number of pounds of wire for two-wire trellis, 600 pounds; staples, 6 pounds; cost	22 80
Number posts for trellis, 202; number braces, 20; cost	14 14
Cost of putting up trellis	3 00
Cost of acre of grapes, exclusive of land	$70 54

Varieties.

The prospective planter will do well to consider carefully the best-known and most popular varieties before planting. More than 75 per cent of the grapes planted in the commercial sections of Canada are Concords and Wordens. The same is true of New York State. The Concord almost alone is used in the grape-juice industry. It is the leading fermented wine grape also. Worden is in second place, being a little earlier, and although a smaller yielder, is cutting into the Concord market for ordinary purposes. Lindley, Wilder, Vergennes, Agawam, Catawba and some related varieties all hold a place for general market purposes and the plantings are increasing. When quality is expected, these are the varieties to grow, but the yield will not be so heavy as for the Concord. Delaware is in good demand because of its quality when well grown. Moyer and Brighton are giving way to better varieties.

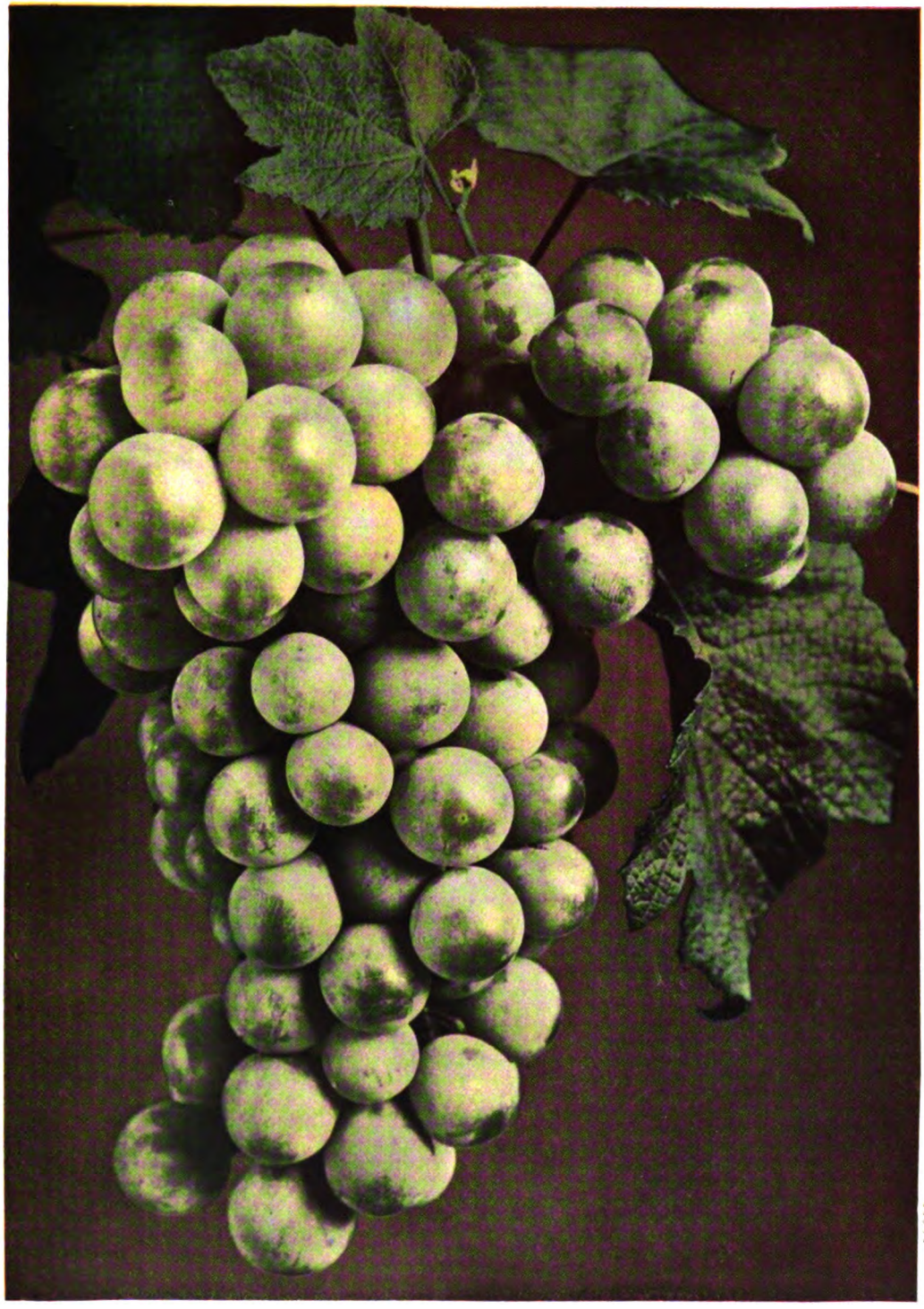
The Niagara, in spite of its many drawbacks, is still a favorite, and although a few years ago it suffered somewhat from over-advertising, it has again found its proper place and is in steady demand. The newer varieties have not been tested long commercially and it is well for the new grower to plant them only in limited numbers until they have proved they are worthy of a larger place.

All the commercial varieties grown out-of-doors are Labrusca or Labrusca-vinifera hybrids and seedlings, and no attempt is being made to grow the pure vinifera.

F. M. CLEMENT.

Grapes in the South.

The region south of the 38th degree north latitude has in it more native species of grapes than all the world besides. This alone would lead one to suppose the South naturally adapted to vineyard culture. Yet New York, Ohio and California up to the present far excel it in vineyard area, although only three or four species are native in these states. The cause of this is that diligent experimenters and originators have pro-



XLIX. The Niagara grape.

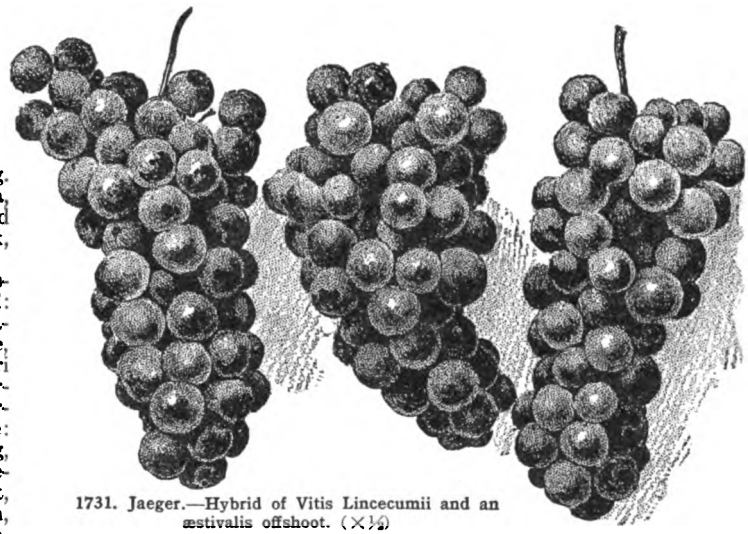
duced varieties of good marketable value adapted to those regions, from natives of the regions, or hybrids of natives with hardiest foreign kinds. In the case of California, the vinifera varieties are mostly grown because the climate and other conditions are so similar to those of the native region of the vinifera. But the South has chiefly planted the northern and foreign varieties which succeed but indifferently in most southern localities, and has neglected almost entirely its native varieties until quite recently. Now experimenters have shown that most excellent and very successful varieties of all colors and seasons can be and have been produced by selection and hybridization of some of the large fine-fruited varieties.

While the foregoing predicts by actual existence in practical market vineyards in a number of localities in the South what is in store for the South as a whole, the present state of grape-culture in that region at large is a different matter. Information gathered from best sources throughout the South shows that grape-culture is a very small industry.

Varieties.

The leading varieties cultivated in the northern sections of the South are Catawba, Concord, Delaware, Early Victor, Elvira, Ives, Moore Early, Moore Diamond, Niagara, Norton Virginia, Perkins, Worden, Wyoming. Favorable mention is made of America, Beacon, Brilliant, Campbell Early, Gold Coin, Green Mountain, Laussel, Ozark, Presly.

East of Texas and south of Tennessee, the following are chiefly planted: Brighton, Champion, Concord, Delaware, Diana, Diamond, Elvira, Goethe, Hartford, Herbemont, Ives, Missouri Reisling, Moore Early, Niagara, Norton Virginia (Cythiana), Perkins, Worden. Of the muscadine class for wine: Flowers, James, Mish, Scuppernong, Thomas. Favorable mention, of varieties testing, is made of Brilliant, Bertrand, Carman, Fern, Gold Coin, Jaeger (Fig. 1731), Laussel, Marguerite, Superb. In the southwestern section, west of the 96th meridian, are chiefly planted the Herbemont, Jacquez (Black Spanish, Lenoir), Niagara and Golden Chasselas, Malaga and some other vinifera varieties near the Gulf coast and in western Texas under irrigation. By several who have had them under trial for several years favorable mention is made of Bertrand, Brilliant, Carman, Fern, Jaeger, Marguerite, Muench, Neva, Perry, as furnishing successful table and wine grapes for this region.



1731. Jaeger.—Hybrid of Vitis Lincecumii and an æstivalis offshoot. (×½)

The following varieties are superior for commercial and home planting in the South, especially the Southwest, and some in the North: Headlight, Brilliant, President, Captivator, Hidalgo, Hernito, Delakins, Salamander, R. W. Munson, Mericadel, Ericson, Krause, Bailey, Extra, Blondin, Jaeger, Carman, Ellen Scott, Armalaga, Edna, Fern, Last Rose, named in order of ripening. These cover a season of ripening in north Texas (latitude of Atlanta, Georgia), from June 25 until September 15 or later. They include white, red and black colors in their different shades, many comparing favorably in appearance and quality with the better vinifera grapes, while the vines are all perfectly hardy in the South and some of them far north, making a fine record in New York and even about Boston. Some of these varieties are now planted largely along the Gulf coast country, where vine-culture was supposed to be impossible a few years ago.

The section of Texas south of San Antonio, lying between the Gulf and the Rio Grande River, as large in area as the state of New York, has a climate and soil excellently suited to the vinifera grapes, and in the last six years, since railroads began to ramify that section, and where irrigation facilities are afforded, considerable plantations of vinifera grapes have been made, the Flame Tokay, Malaga (Pensé), Muscat of Alexandria, Cornichon, Black Morocco, and so on, being the varieties chiefly used. Of course these require grafting upon resistant stocks, in all but the very sandy soils.

Georgia.

For Georgia, Hugh N. Starnes contributes the following notes:

"Leading varieties of grapes for Georgia are as follows: Ives, Concord, Niagara, Delaware, Moore Early, Goethe, Lindley; and for wine, Norton Virginia, Scuppernong and Thomas.

"The general distance apart to plant is 10 by 10 feet; Delawares 8 by 8 feet; Rotundifolias 30 feet. Single-stake spiral method of training is chiefly used, and either spur-renewal or cane-renewal pruning employed, according to circumstances. Some growers employ trellises instead of single stakes, using either one or two wires and adopting the umbrella Kniffin or low wire arm spur Kniffin system of training.

"Very little wine is now made in this state, and that is nearly all claret from Norton Virginia, Ives or Concord. In southern Georgia a poor article of Scuppernong wine is made, but it is not adapted to trained palates. Delaware and Goethe blended are sometimes used to make a very good Rhine wine, and when properly handled sometimes produce an excellent article. Goethe must, reinforced with 20 per cent of California brandy, makes a good pale sherry; yet it is difficult to sell wine here profitably. When it can be sold at all, prices range from 50 cents to $2 a gallon, according to the grade. Grape vinegar, while generally regarded as inferior to cider vinegar, will bring about 25 or 30 cents at retail and 20 cents wholesale, and at these figures is more profitable than wine.

"When sold fresh, the grapes are generally shipped in refrigerator cars in ten-pound baskets to different northern points. Later shipments take a southerly direction to Atlantic, and Gulf seaports. Sometimes the regulation six- or nine-carrier peach-crates are used for shipping grapes, but are not so satisfactory as the ten-pound separate baskets. Delawares are generally shipped in five-pound baskets. Returns are uncertain. They vary from 1½ cents a pound to 5 cents accord-

ing to circumstances. Sometimes as high as 10 cents is realized on very early and very late shipments or with choice grapes, but this is seldom. Distilleries pay three-fourths of 1 cent a pound delivered, or gather and pay ½ cent a pound. If only one ton to the acre of grapes is the yield, the gross return (and also the net return) an acre would thus be from $10 to $15. This is more than cotton ordinarily nets. With two tons to the acre of grapes, which is not an enormous yield, the return would be $30 an acre delivered at the still. To those who have no scruples in regard to so disposing of their crop, this is probably the most profitable method. There are local stills in almost every county.

There is not much encouragement now for grape-raising in Georgia, and vineyards are annually being destroyed by hundreds of acres. Some planting, however, is still going on in southern Georgia, in the "wire grass" country, where the industry is still found profitable by reason of the fact that the northern market may be entered ahead of competition, and also that insects and fungous pests have not yet put in an appearance in that region.

Planting, training, and the like.

The vines of the true southern grapes, such as Herbemont and the Post-oak grape hybrids, are planted 12 to 14 feet apart, in rows 9 feet apart, while such northern varieties as are planted are set 8 feet apart in row. The Muscadines, such as Scuppernong, are mostly grown upon arbors about 7 feet high and rarely or never pruned, although trained on trellis, as are other grapes, and, pruned early in fall, after leaf-fall, succeed excellently. The culture is mostly with the plow, turning first away and then to the rows, hoeing the space along the row not reached by the plow. The trellis mostly used is the 3-wire trellis; first wire at 18 to 24 inches from the ground, and the others successively 1 foot apart, above the first. The training is commonly an indifferent attempt at the Kniffin system, and no system is generally carried out. Some pinch back the leading shoots once, few twice. Some use single posts and spur-prune. A few have made the Munson canopy trough trellis of 3 wires, and report most favorably of it.

Fungicides are used successfully by some. Others plant only such as Ives, Norton Virginia, Moore Early, Perkins, and some other varieties not subject to rot and mildew, so as to avoid spraying. They also avoid, thereby, having grapes of the finer qualities, and get only the lowest prices. From such mostly come the report that grape-culture with them is unprofitable. So it should be, as such grapes in the market have the effect to depress prices on all kinds of grapes. In the moister parts of the South, black-rot, downy mildew and ripe grape-rot are very prevalent, but, excepting the ripe rot, are readily overcome by the bordeaux mixture spray properly applied.

Few growers in the South use fertilizers in their vineyards. Some use barnyard manure, but the more intelligent use cotton seed or cotton-seed meal in connection with ground bone, kainit and soluble phosphates.

Marketing and profits.

The crop is mostly marketed fresh in the local or nearby markets, as the ordinary freight and express rates will not permit profitable returns on the varieties mostly grown. But it has been demonstrated that fine grapes that will carry well can easily be grown in the South, and, when handled in best manner in neat baskets, are profitable.

There are a few established wineries in the South, which use Ives, Norton Virginia, Herbemont, LeNoir, and the Scuppernong and other Muscadine varieties. The chief complaint of wine-growers is that legislation brought about by the prohibition movement is adverse and often entirely prohibitive. In consequence, some have bottled the juice fresh under some sterilizing process, but the people are not yet educated up to the use of this excellent, healthful, nourishing beverage; yet the demand for it is growing, and may be largely increased by enterprising makers.

Reports collected from all parts of the South state the profits all the way from nothing up to $150 an acre, sometimes higher, and it is clearly evident that the intelligence and enterprise of the planter are the chief elements in controlling profits. Of course, localities, soils and varieties play important parts, but an intelligent grower would not select poor locality, situation, soil and varieties to start with, just as he would not pursue poor methods in the conduct of the business.

There appears no reason why the South may not become one of the greatest grape countries in the world and it promises everything to the wide-awake, intelligent grape-grower, for its capabilities are unlimited in the production in quality and season when no other section competes with it, and it has vast markets at home and in the great cities just north of it.

T. V. MUNSON.

Grapes on the Pacific slope.

Grape-growing was introduced into California by the Franciscan Missions during the latter half of the eighteenth century. At all the missions from San Diego to Sonoma the same variety was cultivated practically exclusively. This variety, now known generally as the "Mission" or locally as the "California" and "El Paso," reached California from Mexico through the Jesuit missions of lower California. It seems probable that it was brought over from Europe as early as the time of Cortez but it has never been completely identified with any European variety. It is very close to the Monica of Sardinia which it resembles in its great vigor, heavy growth, the form of its leaves, the size, shape, color, texture, and flavor of its fruit, and differs principally in the less dense indument of its foliage. It seems probable that it is a seedling of this variety selected by the padres on account of its close resemblance to its parent, which is a favorite with the monks of Sardinia. It was admirably adapted for the purposes of the missions, for besides being a good table grape, keeping well and not sensitive to primitive methods of handling, it could be used for the manufacture of white or red wine and was especially adapted to the production of a sweet wine of sherry type.

For a long time, even after the American occupation of California, it remained the only variety grown in vineyards, but, with the arrival of immigrants from various grape-growing countries, other varieties were introduced, and, at present, it is little grown in California except as a good, cheap, easily handled table grape for local supply and in some regions as an ingredient in the manufacture of sweet red and white wines. It still forms the bulk of the vines grown on the Mexican plateau and extends into New Mexico and southwestern Texas, but is gradually giving way even there to varieties better adapted to special purposes. At present, Zinfandel for wine, Muscat of Alexandria for raisins, and Flame Tokay for shipping, constitute the bulk of the grapes grown in California, although about twenty-five varieties are grown on a large scale and over twice that number in considerable commercial quantities. Including all the varieties which occasionally or locally appear on the market as table, raisin or wine grapes, there are over one hundred varieties of commercial importance.

All these varieties, with one or two unimportant exceptions, belong to the European type, *Vitis vinifera*. Varieties of *V. Labrusca* and other American types grow vigorously and bear well except in the hottest and driest sections, but the grapes are unsuited for

the main purposes of the industry in California. They cannot be made into raisins, are inferior to vinifera for wine and are less suitable for distant shipment as table grapes. Scattering, small patches of the variety Pierce (an improved sport of Isabella) are grown in the cooler parts of the northern coast counties, and an occasional patch of Concord in the San Gabriel Valley. The crop of these vines finds a market in San Francisco, Los Angeles and other large coast towns and is often very profitable, but the market is small and easily over-stocked. These grapes attain regularly a higher percentage of sugar and lower acidity than is usual in the eastern states and they have been used successfully in the manufacture of unfermented grape juice, for which they are particularly adapted.

The vineyard industries of the Pacific slope, however, will always be based principally on the growing of vinifera grapes, owing both to their greater intrinsic value for most purposes and to the fact that they cannot be grown on a large industrial scale in any other part of the United States.

Certain American species of vines are nevertheless essential to the success of California grape-growing, owing to their resistance to the phylloxera which rapidly destroys all vinifera varieties whenever it secures a foothold in the vineyard. They are useful as stock on which to graft the vinifera varieties and are extensively used in the northern and central coast counties and in certain sections of the great valley and the Sierra foothills. The insect has not yet become established in southern California nor in Imperial. The chief resistant stocks used are varieties of riparia and rupestris, although certain hybrids of these species with Berlandieri, and vinifera are also used for special conditions. The Labrusca varieties are almost as susceptible to injury from phylloxera in California as the vinifera and also require grafting on resistant stock in infested regions.

The most essential requirement for the successful growth and bearing of vinifera varieties is a dry summer with abundant sunshine and a winter cold enough to render the vines dormant for at least several weeks. These conditions are found in California from the Mexican to the Oregon borders, and in favored locations in several of the other Pacific slope states. Along the coast north of Monterey Bay, the summer sea fogs interfere with the ripening of the grapes and make the control of the oidium difficult. These sea fogs cover a belt which in the north extends considerably into the interior but gradually becomes narrower as one proceeds south, until in the latitude of Santa Cruz, where the mean annual precipitation falls below 20 inches, grapes can be grown almost down to the sea. In the remainder of California, grapes can be grown almost everywhere that the elevation above sea-level is not too great. In the latitude of Napa the limit is about 1,500 to 1,800 feet. Farther south, vineyards are found at Ben Lomond in Santa Cruz County at 2,500 feet and at Colfax in Placer County at 2,400 feet. At these elevations vines succeed only in favored locations. In others and at higher elevations, killing frosts often occur both in spring and autumn.

Grape-growing in a large way began in California soon after the American occupation. In 1858, according to the State Register, there were 3,954,548 vines in the state, equivalent to about 6,500 acres. Collections of European varieties were introduced and state aid was secured for the promotion of viticulture. By 1870, the vineyard acreage had increased to nearly 30,000 acres. Wine was produced in fairly large quantities, but its sale was at first attended by many disappointments which discouraged planting and for ten years the new vineyards barely sufficed to compensate for the loss of vineyards by phylloxera in the north and a peculiar disease of unknown cause in the south.

In the meanwhile, the demand for Californian wines increased and a propaganda for extension with more suitable methods and better varieties was earnestly taken up. Again the state granted funds liberally, and the agitation resulted in vine-planting and cellar-construction throughout the state. At the same time, vast plantings were made in the new Fresno region and between 1880 and 1883 the vineyard area of California increased from about 35,000 acres to nearly 140,000.

This rapid expansion naturally led to over-supply and inferior products, which restricted further extension. In the period from 1891 to 1897 the vineyard area actually decreased owing to the rapid destruction of the vines of the large Santa Clara section by phylloxera and drought. In 1904 the vineyard area was estimated to be about 200,000 acres and since then the new plantings, especially of table grapes, have been steady and the area in 1913 may be estimated roughly at about 385,000 acres, of which about 75,000 consists of table grapes, 130,000 of raisin grapes, and 180,000 of wine grapes.

The vineyard products of California, according to the statistician of the California State Board of Agriculture, for 1912 were: Wine, 47,491,772 gallons; brandy, 8,721,693 gallons; raisins, 185,000,000 pounds; table grapes, 6,363 (1913) carloads.

1732. Trunk of a vinifera grape, with the fruit-bearing canes cut back.

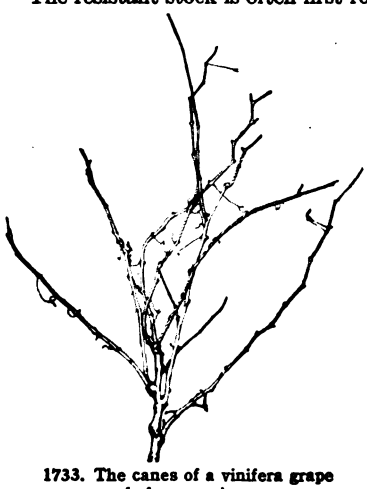
Vinifera varieties of grapes have a very wide range of adaptation. They grow in all fertile soils, but succeed best in light, deep, warm loams in the valleys and on the hillsides. The American varieties used as stocks are less adaptable and some care must be exercised in choosing a stock suited to the chemical and physical character of the soil. The extremes of temperature and elevation endured by vinifera vines are very great, especially if care is taken in the selection of varieties.

In the Pacific coast states outside of California, the growing of grapes is still largely experimental. In parts of Oregon and near the confines of Idaho and Washington almost to the borders of British Columbia, vinifera varieties of table grapes are giving very promising results in favored locations. The vines need some protection in the winter by covering with straw or earth, but the hot, dry summer will ripen even such southern and late varieties as Flame Tokay and Cornichon. The American varieties succeed in a much wider territory in these states. The varieties most favorably mentioned are Concord, Delaware, Diamond, Moore, Niagara and Worden. In parts of Arizona and of southern Nevada and Utah, vinifera vines have been planted and promise to be profitable for local sale or, in special locations, for early shipments.

Propagation and cultivation.

New vines are grown from cuttings of one-year-old dormant wood. These cuttings should be from 10 to 18 inches long, the shorter cuttings for moist soils in the cooler localities and the longer for drier soils in hot regions. A 14-inch cutting is usually employed. It is generally best to root the cuttings in a nursery and plant them out in the vineyard the following spring. In well-prepared, moist soil they may be planted directly in place, only one bud being left above the surface. Where phylloxera exists, resistant vines must be used. These are obtained by grafting a one- or two-

bud cutting of vinifera on a 9- to 12-inch resistant cutting from which the buds have been removed. This graft is united in a callusing bed, rooted in the nursery and planted out in place when one year old. The resistant stock is often first rooted in the vineyard and grafted in place when one or two years old. This method is uncertain and gives many poor unions except with a few stocks and in very expert hands.



1733. The canes of a vinifera grape before pruning.

The soil should be plowed as deeply as practicable before planting. The best vineyardists turn the soil 9 to 12 inches, often following with a subsoiler penetrating 6 or 8 inches deeper. This treatment results in a more complete "stand," quicker development and full bearing at three to five years. It is especially useful for grafted vines.

Resistant stocks.

The principal phylloxera-resistant stock grown is the rupestris St. George (=du Lot). It succeeds in a wide variety of soils providing they are deep, permeable and well supplied with water below. In shallow, compact or very wet soils it often fails. It forms good unions with most of the common vinifera varieties. Exceptions seem to be, in some localities, Emperor, Cornichon and Muscat. For the shallower soils of the coast counties, riparia × rupestris 3309 is to be recommended; for stiff clay soils, Berlandieri × rupestris 420 A; for rich, moist, well-drained soils in the cooler locations, riparia gloire de Montpellier. For varieties of difficult affinity the Mourvèdre × rupestris 1202 is promising in soils similar to those suited to St. George.

Pruning and thinning.

It must be recognized that the vinifera grapes have a different habit of growth from the native grapes grown in the East. They are not always trained on wire trellises. The old trunk (Fig. 1732) is short and stump-like and supports itself. The cane-growth (Fig. 1733) is relatively short, and it is cut back to near the head of the trunk, as shown in Fig. 1732, and also in Fig. 1734.

In the first year, the vines need no attention except thorough cultivation and one or two irrigations in dry sections. In the following winter, the dormant growth is thinned to one cane which is cut back to one or at most two buds. The vines should then be staked. Redwood stakes, 3 to 4 feet long and 1½ inches thick, are the best, placed 2 inches from the vine on the leeward side. These are sufficient for the goblet system of training, but longer stakes may be necessary when canes are left at pruning.

During the second year, all buds or shoots but one should be removed before they have made any considerable growth. The whole energy of the vine is thus forced into a single shoot which should be carefully tied to the stake and, if vigorous, topped at about 3 feet to cause it to produce laterals. All suckers from below ground should be carefully removed at their origin and also any cion roots which may develop on grafts. At the second winter pruning, all canes but one should be cut off clean if more than one has been allowed to grow. This cane should then be cut back to the height at which it is desired to "head" the vine, which will be about 15 inches for small-growing vines such as Zinfandel and 24 to 30 inches for heavy-growing vines such as Flame Tokay. Table grapes, as a rule, are headed higher than wine or raisin grapes. When strong laterals have developed, these should be left with one or two buds when they occur in positions where it is desired to develop arms.

In the third year, no shoots should be allowed to develop on the trunk of the vine within 8 to 15 inches of the soil, according to the height of the head. It is usually necessary to pinch back all the shoots from the head when they are 15 to 18 inches long to protect them from wind injury while they are still brittle. At the end of this year, the vine should have developed sufficiently so that it can be given three to six spurs in the positions desired for the permanent arms. These spurs should consist of two to four buds, the more vigorous the vine the more spurs and the more buds.

In the future prunings, the number of spurs is gradually increased until the vine reaches its adult stature. The number will vary from four or five to fifteen or twenty, according to the vigor of the variety and the distance apart of the vines. During the first four or five years, great attention should be given to forming the vine with a clean vertical trunk and symmetrically placed arms and also, with grafted vines, to the careful removal of stock suckers and cion roots. As the vines become older and less vigorous, the spurs left at the annual winter pruning should be shorter, consisting usually of only one or two complete joints.

This method of pruning, illustrated by Fig. 1734, is known as the vase or goblet method and is adopted in most of the vineyards of California. A few varieties, notably the Sultanina (=Thompson Seedless) do not bear satisfactory crops with this method. For such varieties the treatment for the first three or four years is the same, but at that time it is necessary to erect a trellis. This consists usually of two No. 11 or No. 12 galvanized iron wires stretched along the rows at about 18 and 36 inches from the surface of the soil. These wires are supported by redwood stakes 6 feet long and about 2 inches in diameter. The vines are then pruned by leaving a suitable number of "fruiting canes" about 4 to 6 feet long, which are tied to the wires. Near and below the base of each fruiting cane is left a "renewal

7734. The common short-pruning goblet system used for the vinifera grape in California.

spur" consisting of two buds, whose function is to supply a fruit-cane and renewal spur for the following year. Care should be exercised to choose fruit-canes which originate from the spurs of the previous year and not from older wood. The vines, instead of being given the symmetrical goblet form described, should

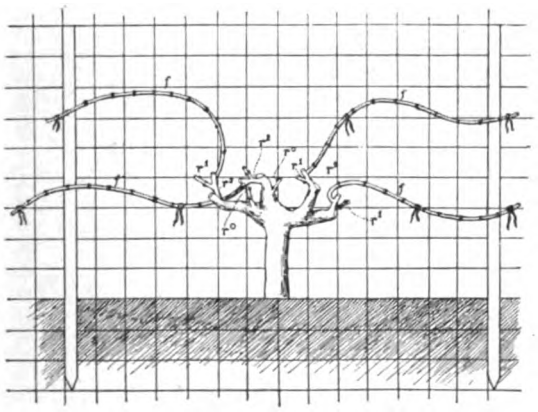
be flattened fan-shape to facilitate cultivation, which can take place only in one direction. This method of pruning and training is shown in Fig. 1735.

Goblet-pruned vines are planted on the square system from 7 to 12 feet apart, 8 feet apart being usual for the northern coast counties and 9 or 10 feet for the hotter regions. Muscat of Alexandria vines are usually planted 6 by 12 feet to 8 by 14 feet to facilitate drying the raisins, and trellised vines are usually planted in the same way.

Some special practices and modifications of the usual methods are found to be useful in the production of table grapes for shipping. In general, the vines should be raised a little higher and the arms given a somewhat wider spread. This is to keep the fruit from contact with the soil and to spread out the bunches so that they will develop, ripen and color evenly. The removal of water-sprouts and sterile shoots, not needed for new arms, before or soon after the grapes set is also very useful. This tends to make the bunches and berries larger by concentrating the energies of the vine on the bearing shoots. An equally important effect of this practice is to facilitate the gathering of perfect bunches. When neglected, the water-sprouts often grow through the bunches. Such bunches cannot be gathered without injury. Some of the grapes are pulled off, some broken and, worst of all, some of them are slightly loosened around the pedicel. Most of the broken berries can be removed by the trimmers in the packing-house, but many of those simply loosened escape their scrutiny and are a fruitful cause of decay.

Many otherwise suitable grapes do not ship well on account of the excessive compactness of the bunch. A compact bunch is difficult to pack without injury and cannot be freed from imperfect berries without spoiling good berries.

This excessive compactness can be prevented by thinning before the berries are one-third grown. Thinning, moreover, increases the size of the berries, hastens ripening, promotes coloring, and lessens some forms of sunburn. The practice has been employed with success by growers of Tokay, Black Morocco, and other

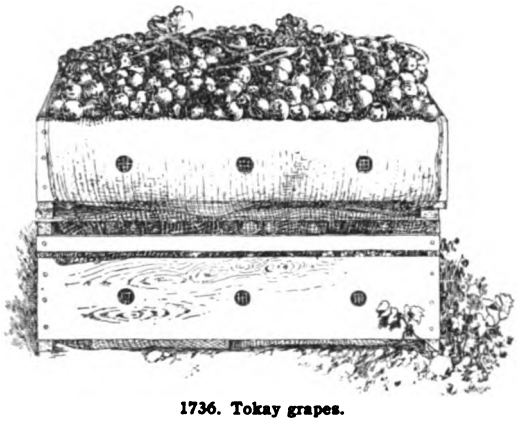


1735. The long-pruning of vinifera vines. The vine is trained on two horizontal wires.

f f, Fruit-canes growing out of the renewal spurs r^2 the previous year; r^1, renewal spurs to supply fruit-canes for the following year; r^0, replacing spurs to supply wood for use when the over-elongated arms are cut back.

grapes in northern California. While apparently costly, the expense is often more than counterbalanced by the saving in trimming of the ripe grapes. The increase of quality thus becomes a net gain.

The bunches are thinned at any time after the berries have set and before they have reached one-third their mature size. No bunches are removed, but only a certain proportion of the berries of each bunch. The number of berries to be removed will depend upon how compact the unthinned bunches usually become. In general, it will vary from one-third to one-half of the total number. The thinning is effected by cutting out several of the side branchlets of the bunch. The branchlets should be removed principally from the part



1736. Tokay grapes.

of the bunch which has most tendency to compactness, usually the upper part. The work can be done very rapidly as no great care is necessary in preserving the shape of the bunch. However irregular or one-sided the bunch looks immediately after thinning, it will round out and become regular before ripening. A long, narrow-bladed knife or a pair of grape-trimming scissors can be used conveniently for this work.

Harvesting and packing.

The grapes should not be harvested until they contain at least 17 to 19 per cent of sugar, varying with the variety and the locality. Unripe grapes are distasteful to the consumer, spoil the market for later and better grapes, and are more liable to deterioration from wilting and decay. After every care has been taken to produce good shipping grapes on the vines, their proper handling is no less important. A bunch of grapes which is perfect in the vineyard may easily be ruined by careless gathering or hauling before it reaches the packing-shed.

The grapes, in gathering and packing, should be touched as little as possible and handled only by the main stem. They should be placed carefully in wide, shallow boxes in a single layer. Hauling to the packing-house should be done very carefully, in wagons provided with springs. The grapes should be protected from the dust and the direct rays of the sun, and the boxes should be so stacked that there is no danger of crushing the grapes. Fig. 1736 shows two crates or boxes of grapes.

The most usual way of packing table grapes in California is in square chip baskets holding about five pounds and placed in fours in open-sided crates. Extra-large bunches or "clusters" are sometimes packed in oblong baskets of twice this size, of which two are placed in a crate. Experiments have been made with various "fillers" to protect the grapes during transit and to increase the time during which they will remain in good condition. The cork-dust or waste used in Spain for the grapes of Almeria is unavailable. Various substitutes have been tried. Early attempts to utilize ordinary sawdust for this purpose proved unsuccessful for the reason that the grapes failed to hold in good condition and absorbed disagreeable flavors from the wood. Recently it has been demonstrated that pure, dry redwood sawdust, from which the chips and finest particles have been removed by screening, is even superior to ground cork for grape-packing. Redwood

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is neutral in odor and flavor and imparts no disagreeable taste to the grapes packed in it and held in cold storage. During the past three years this method of packing and storing has received wide commercial application. The shipments of Emperor grapes packed in sawdust during 1913 amounted to nearly 300 carloads. Table grapes for local markets are often shipped in the fifty-pound "lug" boxes in which they are gathered.

Raisins.

Practically all the raisins in California are sun-dried. Artificial driers were formerly used to some extent to dry the second crop of Muscat and are still used occasionally to finish drying in seasons of early rains. The second crop is now utilized by the wineries.

Muscat grapes should not be gathered for raisin-making until they show at least 24° Bal.* of sugar. Better raisins are made at 26° to 27° Bal. The crop increases with increasing ripeness. At 27° Bal. the yield of raisins to the acre may be 40 per cent greater than at 23° Bal. The grapes are gathered on wooden trays with cleats, holding twenty-two pounds of grapes which dry to five and one-half to seven pounds of raisins. The trays are furnished with bottom and top end cleats which allow a space of 2½ to 3 inches for the grapes when they are stacked. The filled trays are placed in alternate rows running east and west where the soil has been given a slight inclination by means of a V-shaped scraper in order to expose the grapes more directly to the rays of the sun. After about nine to twelve days, the grapes are turned by

1737. Stacked trays of raisins.

placing an empty tray on top and inverting the two trays together. In about three to four days after turning, they are dry in good weather, but the total time of drying may vary from about ten days to nearly a month according to the ripeness of the grapes and the temperature and moisture of the air. The best raisins are made when the average maximum daily temperature lies between 85° and 90° F. Above 100° F. the grapes are somewhat injured in flavor and appearance but still make good loose or seeded raisins. If rain falls after the grapes have begun to dry, especially after they have been turned, they are liable to injury. When rain threatens, it is sometimes necessary to pile the trays up in stacks and to spread them out again as soon as the rain or the danger is over. In some seasons this stacking has to be repeated two or even three times, much increasing the cost and time of drying. (Fig. 1737.)

When the grapes are nearly dry, the full trays are stacked in piles of 12 or more and covered with an empty tray. Here the drying is completed and the moisture equalized. They remain in the stack for a week or more and are then placed in large "sweat-boxes" holding about ninety pounds of layers, or 125 pounds or more of loose raisins. When fine layer raisins are made, these are picked out by hand before putting in the sweat-boxes and the layers separated by sheets of paper. The raisins are delivered to the packing-houses in the sweat-box.

Sultanina and Sultana grapes are sometimes cured in the same way as the Muscats, but the resulting raisins are of a dark amber-color and cannot compete with the light golden yellow Sultana raisins. These are made by passing the grapes through a "dip" and then through a sulfur-box before drying.

Various dips are in use, the commonest being composed of one pound of good potash lye in twelve gallons of water. This is kept boiling hot and after immersion in it for an instant, the grapes are plunged in cold water and placed on the trays. Some growers add an emulsion made of three-fourths of a pound of lye, one quart of olive or of the purest cottonseed-oil, and three quarts of water. A gallon of this emulsion is added to each ten gallons of the lye-dip. Some growers say that they secure equally good results by dipping simply in boiling water. Similar dips are sometimes used to facilitate the drying of second-crop or inferior Muscats and such grapes as Malaga and Feher Szagos.

After dipping, the grapes on trays are exposed to sulfur fumes and spread out to dry. In hot weather much of the drying is done in the stack, too much exposure to the hot sun tending to darken the color of the raisins.

Raisins or dried grapes are of four main classes: (1) Raisins proper, of which the dried fruit of the Muscat of Alexandria is the type. California produces more than half the world's crop of this class. Most of them are made from the Muscat of Alexandria or from its variation, the Muscat Gordo Blanco. When the demand is good, Malaga, Feher Szagos and occasionally other large sweet white varieties are used. (2) Sultana raisins are made from the Sultanina (=Thompson Seedless or Oval Kechmish). California also produces large quantities of this class, the principal centers of production being the upper San Joaquin Valley and Sutter County in the Sacramento Valley. The Sultana (=Round Kechmish), also a seedless grape, is grown in large quantities, principally in the Sacramento Valley. From it is produced a raisin resembling a small Sultana in appearance but more allied to a "currant" in flavor. Both of these varieties require long pruning with fruit-canes of 4 to 8 feet. (3) Currants which are made from the very small seedless Black Corinth and to a less extent from the somewhat larger White Corinth, are not produced on a commercial scale in California. The Black Corinth does not bear and the White Corinth produces a raisin which is too large to pass as a "currant" and too small to secure a remunerative price as a "Sultana." (4) Dried grapes are made from almost any kinds and are occasionally produced in large quantities when the price of fresh grapes is low. They are used for various purposes, principally for the manufacture of imitation wines in foreign countries.

Grapes for shipping.

Table grapes are grown all over California for family and local consumption and include hundreds of varieties, principally vinifera. The commercial growing of table grapes, however, is for the purpose of shipping to large centers of population, especially in the eastern states. It is localized in certain regions and utilizes a comparatively small number of varieties.

The earliest grapes come from Imperial County in June, followed in July and early August from Fresno, Kern and Tulare Counties and from the warm eastern slopes of the inner coast range in Yolo County. The earliest variety is the Luglienga, usually shipped under the erroneous name of Madeleine; the next the Chasselas doré, usually called Sweetwater; both are white. These varieties have not given satisfaction in Imperial, where Persian No. 23, and allied varieties, promise

24° Bal. means that the juice has the same concentration as a pure sugar solution of 24 per cent. The juice is tested by a Balling hydrometer for sale by all chemical supply houses.

better results for the earliest markets. The Khalili is even earlier then the Luglienga and seems promising for Imperial. Blue Portuguese is the only very early black grape that appears on the market and is of poor quality. Bellino is promising for Imperial County but loses its extreme earliness farther north. By the middle or end of July all varieties are ripe somewhere, the latest varieties ripening about that time in the earliest localities. Distinctions regarding earliness apply, therefore, more to districts than to varieties.

The Flame Tokay, which appears to be identical with the Amar bou Amar of Algeria, is the chief shipping grape of California. It fails to develop its bright red color in Imperial so that the first shipments are from the Winters and Vacaville region. The bulk of the crop is raised in the middle part of the Great Valley from Stockton to Sacramento, Lodi being the principal center. There are numerous other smaller centers of production, the latest being the Santa Cruz Mountains. The next most abundant varieties are the Malaga, the principal variety of the Imperial Valley, a white grape raised largely also in the San Joaquin Valley from Tulare to Stanislaus County, and the Emperor, a large, late red grape raised chiefly in Tulare and Fresno but more or less in several other counties from Los Angeles to Sacramento County. In the cooler regions its color is almost black. The Cornichon (=Malakoff Isjum), a long, late, black grape, the Black Prince (=Rose of Peru), a moderately early round grape, and the Verdal, a very late white grape, are also largely raised, the last only in the Santa Cruz Mountains. The Black Morocco (=Trevoti), the Ferrara, the Gros Colman and the Pizzutello are also raised in considerable quantities. Promising new varieties are the Olivette de Cadenet, Flame Muscat and some of the Persian varieties, especially the Paykani Razuki, a brilliant red grape which bears well only when grafted, except in the Imperial Valley. The Muscat of Alexandria and the Sultanina (=Thompson Seedless), while primarily raisin grapes, are shipped as table grapes in large quantities in most seasons. The only eastern variety grown for the market is the Pierce, which satisfies the small demand for a "slip-skin."

All the varieties of table grapes mentioned succeed with the goblet form of pruning, although some, such as the Malaga, Cornichon and Emperor, require fairly long spurs and in very rich soils even moderate long pruning.

The grape season in California extends over at least six months. The earliest varieties ripen in the Imperial and Coachella Valleys by or before June 1 and the latest varieties in the latest localities do not ripen until November 1 and in dry autumns may hang on the vines in good condition for a month longer.

Grapes for wine.

The great bulk of all the red wine, both dry and sweet, is made from the Zinfandel. This variety was introduced very early into California but its identity has never been established. It has many good qualities. It bears at an early age and with short pruning. If the first crop is destroyed by spring frosts it produces regularly a fair second crop. It succeeds best in the warmer parts of Napa and Sonoma Counties. In the cooler parts it fails to develop its color or flavor. In the hot interior it is subject to sunburn and its peculiar flavor becomes unpleasantly intense. Other widely grown red wine grapes are Petite Sirah, Alicante Bouschet, Carignane, Mataro and, in southern California, Blue Elbling. Varieties recommended for dry red wine in the coast counties are Petite Sirah, Barbera, Beclan and Cabernet Sauvignon; for the hotter interior, Valdepeñas, Lagrain and St. Macaire; and for sweet reds of Port type, Grenache, Alicante Bouschet, Tinta Madeira and Trousseau.

The dry white wines are made from a large number of grapes of which the chief heavy-bearing varieties are Burger, Palomino, Feher Szagos and Green Hungarian and the chief high quality varieties, Colombar, Semillon and the Rieslings,—Johannisberg, Franken and Gray. The sweet white wines are made from the above-mentioned heavy-bearing varieties and also from Mission, Grenache and other light-colored red grapes. Large quantities of wine and brandy are also made from the culls of raisin and table grapes and in years of overproduction from the main crop. Varieties recommended for dry white wine are the Rieslings in the coolest localities, Semillon and Colombar for the warmer parts of the coast counties, and Burger, Green Hungarian and Vernaccia Sarda for blending wines in the interior. For sweet wines Palomino, Beba, Mission and Grenache are suitable.

Various degrees of pruning are needed for these different varieties but in a general way the heavy bearers should be pruned short and the fine varieties long.

Diseases and insects.

Vines on the Pacific slope are remarkably free from serious fungous diseases owing to the absence of summer rains. Oidium (*Uncinula spiralis*), the only exception, occurs everywhere but is controlled cheaply by one or two thorough dustings with fine sulfur in the warm interior and two to four in the coast regions. The ubiquitous saprophytic blue, gray and black molds sometimes injure late grapes in wet autumns.

Insect pests are more serious. The phylloxera renders resistant stock necessary in most of the older districts. The vine-hopper (*Typhlocyba comes*) is often very troublesome in the warmer regions, but its attacks can be much lessened by complete clearing out of green growth a week or two before the starting of the buds, timely use of a hopper-cage to trap the over-wintering adults in early spring before they deposit their eggs and by a nicotine spray in May or June when the first brood appears. Much injury is done locally by the grape root-worm, the larva of the grape beetle, *Adoxus vitis*. It can be controlled by spraying the vines in May with lead arsenate which kills the adults before their eggs are laid. Erinose (*Phytoptus vitis*) is widely distributed but seldom harmful and easily controlled with dry sulfur as used for oidium. Climbing cut-worms (larvæ of Noctuid moths) are very generally harmful to the buds and young shoots in many seasons. Most species can be controlled by the use of poisoned bait. The bait most used is made by mixing forty pounds of bran with two gallons of molasses and five pounds of arsenic. A better bait is made by mixing twenty-five pounds of bran and twenty-five pounds of middlings with five pounds of arsenic and applying dry. A pinch of the bait is placed at the base of each vine or, with large vines, in the center of the head. Grasshoppers and other general feeders are sometimes troublesome, especially in new districts.

A number of imperfectly understood diseases whose causes are unknown are recognized. The chief of these is the Anaheim or Californian disease. This name is inappropriate as it seems to occur also in southern Europe and Algeria where it is ascribed to over-bearing coincident with a series of dry seasons or other weakening causes. Another widely spread disease of a similar nature but less fatal is known as Little-leaf. Various causes for this disease have been suggested, but the most plausible opinion seems to be that it is a case of mal-nutrition due to unfavorable soil temperatures during the spring.

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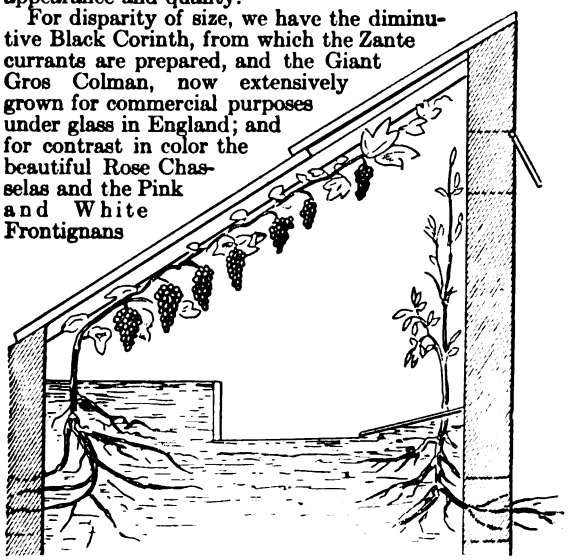
F. T. BIOLETTI.

Grapes under glass. (See, also, page 1261.)

Under glass, the European varieties alone are used. This species, *Vitis vinifera*, is the vine of the ancients, and is indigenous to the more salubrious parts of eastern Asia and southern Europe. It is referred to in the earliest mythological writings of ancient Egypt and thence on numberless occasions, notably in the Bible and the New Testament. The story of the spies from the promised land, with its generous illustration, has excited the admiration and perhaps questioned the credulity of many of us. It is only fair, however, to state that the size of the cluster there represented has been amply borne out in recent years. The type *Vitis vinifera*, if there ever was a type, has become so merged and modified by cultivation in different climates and countries that it is difficult to trace it at the present day. Over 2,000 varieties are described, covering the widest range in size, color, texture and flavor, general appearance and quality.

For disparity of size, we have the diminutive Black Corinth, from which the Zante currants are prepared, and the Giant Gros Colman, now extensively grown for commercial purposes under glass in England; and for contrast in color the beautiful Rose Chasselas and the Pink and White Frontignans



1738. A good lean-to grape-house. The roots run through the wall to an outside border.

and Muscats, with their superb qualities and flavors, growing by the side of the blue-black Alicante of thick skin and coarser texture, but valuable for its late-keeping quality; and worth more than all the others put together, the Black Hamburgh, combining all the good qualities easy of culture.

Probably in no branch of horticulture is the gardeners' skill more generously rewarded than in grape-growing under glass. In England it has been an essential feature of horticultural work for more than a century, resulting in fruit of a finer quality and flavor than that grown in the open air and very often enormous clusters, weighing from twenty to thirty pounds. Started there as a matter of luxury, it has become of late years a matter of profit, and vineries of large extent have been erected for commercial purposes. Probably this work has been retarded here by the introduction of the many very excellent varieties of our native grapes, *V. Labrusca*, so easily grown in the open air and so constantly improved by hybridizing with the European, and undoubtedly this work will yet result in a much closer approach to the standard of European quality.

The essential difference between American and European kinds is that in the American the pulp separates from the skin, is usually tough and more or less acid, so that it is disagreeable to remove the seeds, while in the European the pulp adheres to the skin, is tender and sweet throughout, and the seeds are easily removed. European grapes, when well grown, are valuable and agreeable for the use of invalids, and, undoubtedly, in the judgment of the majority of persons, surpass in quality any other fruit grown.

The subject of grape cultivation under glass may be divided under several heads, as follows: *The houses; The border; The vines; The fruit.*

The houses.

Houses are mainly of two forms, span-roof and lean-to, with occasional modifications between. Unless one has ample time and a desire to study their construction, it is better to have plans and estimates furnished by professional builders.

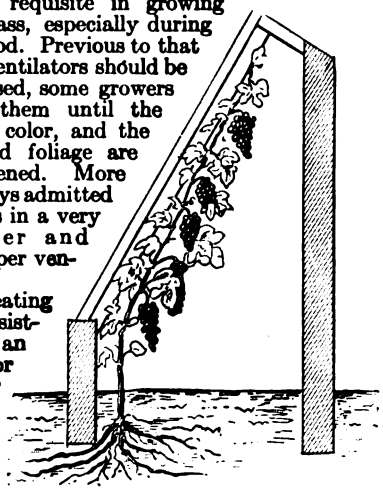
Span-roof houses are adapted to large places with spacious grounds, and especially where an ornamental effect is desired. On account of their exposure on all sides, they require very careful attention, especially if used for early forcing of grapes. When early work is not desired, or for use without artificial heat, their disadvantage is not so apparent. Houses without artificial heat, known as cold graperies, were in earlier years in more general use than those with heat, but have about disappeared with the introduction of the modern economical heating apparatus, and the very great advantage in the use of the same, if only to a limited extent.

Lean-to houses, on account of their snug construction and protection from northerly or prevailing winds, are especially desirable for early forcing of grapes (Figs. 1738, 1739). Often a stable or other building may be utilized for the north side, but generally a wall of brick or stone is erected for this purpose. Such a wall can be covered on the outside with *Parthenocissus tricuspidata*, or Crimson Rambler roses, producing a beautiful and ornamental effect. A good house, on a small scale, can be made of hotbed sash (Fig. 1739).

Foundations for the other three sides or for a span-roof vinery can be constructed of masonry or wood. Masonry is preferable, as the conditions of heat and moisture requisite are very destructive to woodwork, especially near the ground. With masonry, piers are erected, starting from solid ground and up to near the surface. They should be about 2 feet in length with spaces of 2 feet between, and opposite each space a vine is to be planted inside the house, as hereafter described. Strong capstones thick enough to come slightly above the surface of the border and about 18 inches wide are then laid from pier to pier. On such a foundation a superstructure can be erected with some confidence. For the base of the superstructure masonry is preferable, about 18 inches in height being necessary before the glasswork begins. A hollow wall, constructed of hard brick and cement, is desirable, and openings should be left for ventilation. The upper surface of these walls should be covered with cement. If constructed of wood, the same general plan should be carried out, using the most durable kind only.

Aside from its durability, masonry has an advantage over wood in being a better equalizer of temperature, and the heavy back wall of a lean-to house can be made of great value for this purpose. The general plans of the superstructure are shown in the illustrations. It should present as much glass surface as possible. The frame can be of iron or wood, as preferred. Light, heat and moisture are the great features desired, also a generous supply of air under favorable conditions. The glass should be of good quality, otherwise blisters will burn the foliage and fruit. Small ventilators

should be built in foundation walls, and large ones at the upper part of house. A special ventilator covered with wire gauze is desirable for the lower opening. Ventilation should always be free from draft or sudden change of temperature. A draft is as unpleasant to a sensitive vine in a house as to a human being, and if subjected to it disease is sure to follow, mildew being the first evidence; and yet a generous supply of air is a prime requisite in growing grapes under glass, especially during the ripening period. Previous to that time the lower ventilators should be very carefully used, some growers never opening them until the grapes begin to color, and the new growth and foliage are somewhat hardened. More or less air is always admitted around the glass in a very equable manner and thence to the upper ventilators.



1739. Lean-to grapery glazed with sash.

The modern heating apparatus, consisting of a boiler in an adjacent pit for heating water with circulating pipes throughout the house, as shown in illustrations, is a very perfect and economical supplier of heat, and it should be erected by a practical builder. A little heat at a critical time will often save a house full of grapes, and, while it can be dispensed with, its advantages are very material.

It is possible to fruit grapes in benches in pots, removing the pots when the fruit is past, and using the house for other purposes (Fig. 1740).

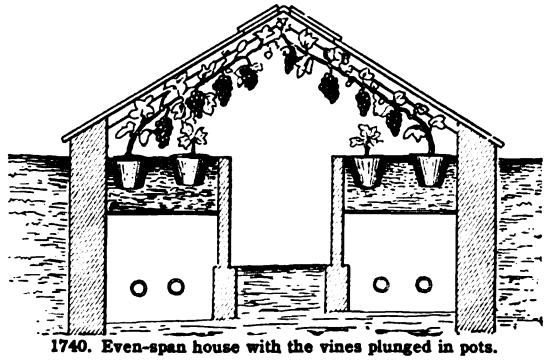
The border.

A good border is of great importance, as no permanent success can be obtained without it; probably the difference between success and failure more often lies here than in any other feature.

It is a good plan to construct vineries so that their borders can be somewhat elevated above the surrounding ground, as better drainage is thus secured, and good drainage is imperative (Fig. 1738). The border should fill the house inside and extend outside adjacent to where the vines are planted at least 6 feet when first made, and to this outside border additions should be made every two or three years of 2 to 4 feet until a width of 20 feet is secured. The border can hardly be made too rich, provided the material is well decomposed. A mixture of six parts good loamy turf from an old pasture or piece of new ground, and one part of well-prepared manure, one part old plaster or mortar, and one part of ground bone, all to be well composted together, will meet all the requirements. If the subsoil is clay, a foundation of old brick and mortar is very desirable to insure drainage. The border above this should be from 2 to 3 feet in depth. No trees or shrubs should be permitted to extend their roots into it, a very common cause of trouble, and nothing whatever should be grown on it, although the temptation to try a few melons or some lettuce is often too great to be overcome, and these probably do a minimum of damage. In such a border, if properly supplied with water, the vine roots will remain at home, and not go wandering off into trouble. When extra-early work is not desired, no attempt should be made to keep the frost entirely out of the border during the winter, as this is apt to result in a heavy, sodden surface in spring. It is better to spade it up roughly just before winter and cover with a good coat of manure, permitting the frost to enter the ground some inches. In the spring, it is dug over again and, when raked off, presents a rich, lively surface. The inside border is to be covered with a coat of well-rotted manure, and spaded up and well watered at the time of starting the vines. For midseason work from February 15 to March 1 is the proper time to do this in New York state, the inside border carrying the vines nicely until the outside border is in shape a month or more later. Then without hard forcing early grapes can be brought in by the last of June or July, and the later ones through the following two or three months. It is better to store late grapes in modern grape-rooms, where they can be kept fresh and plump for several months through the winter, than to attempt extra-early work by starting vines in heated borders in November and December.

The vines.

The amateur should purchase plants from some nurseryman of established reputation. Vines one or two years old are better than older ones. For supporting the vines light cast-iron brackets are secured to the rafters, and these support wires running lengthwise of the house about 15 inches from the glass, and to these wires the vines are tied as fast as they grow. The vines are to be planted inside the house about a foot from the front wall and about 4 feet apart, placing one opposite each opening in the foundation as before described. It is not desirable to plant them along the back wall of a lean-to house. They should be cut back to two or three buds near the ground, and when these start the strongest shoot only is selected for training and the others rubbed off. As this shoot advances it is tied to the wires and it may reach the limit of the house by July 1, or perhaps not until September 1, depending on the care, the vigor of the vine, and the border. Once there, the end is pinched and the cane continues to strengthen and increase in size and store up material in the lateral buds until the end of the season, when it is taken down and pruned to one-third its length, laid on the ground and covered from the sun for the winter. Care should be taken that mice do not eat out the buds, as once out they can never be restored. In the spring of the second year, or as soon as it is desired to start the vines, they are tied up again, and the terminal shoot again trained to the top of the house, where it is stopped as before. Any fruit appearing on this shoot should be removed. The lateral shoots that start out each way



1740. Even-span house with the vines plunged in pots.

below the terminal should be thinned to about 12 or 15 inches apart on each side. This is an important feature, especially if one adopts the spur system of pruning, which will be first considered, for the vine is being established for a long term of years, and it is desirable to have it symmetrical, with the side shoots and fruit evenly distributed over its entire length. An example of a well-balanced vine is the illustration of the Muscat of Alexandria (Fig. 1743). A few clusters of fruit may be taken from this part of the vine this second year, and the

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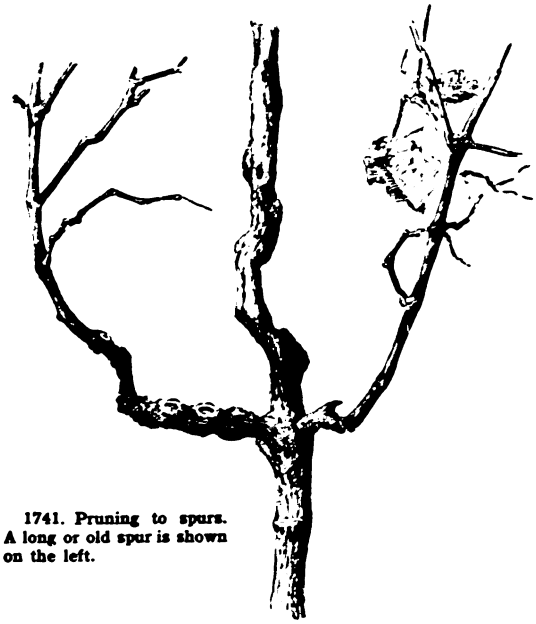
laterals should be pinched at two eyes beyond the cluster, and as they break pinched again through the season. As soon as the leaves fall the vines are again taken down for pruning. The terminal should be shortened about one-half and side shoots cut back to a bud very close to the main stem, when it goes through the winter as before.

At the beginning of the third year, the terminal again goes to the top of the house without fruit, when it is stopped and the laterals are allowed to bear as before, say not more than one pound of fruit to a foot of the main stem. The vine is now established to the top of the house, and the only pruning in after years is to cut the laterals each year close to the main stem. A bud will nearly always be found in the first ⅛ inch, sometimes several of them. When these start, the strongest is selected and the others rubbed off, unless one is desired for training to the opposite side to fill a vacancy there. When the vines attain full strength, two pounds of fruit to the foot of main stem can be grown, but heavy loads require great care. Too heavy a load causes shanking, and then all is lost. The stems of the berries wither and the fruit turns sour before ripening. Rigid pinching of the laterals is very important. Commence at the second joint beyond the cluster, or about 18 inches from the main stem, and pinch thereafter as fast as new shoots break and show a leaf. Pinch early and often. It has been said that a good gardener can carry the summer prunings from a large vinery for an entire season in his vest-pocket. Some require a wheelbarrow. At the place where the laterals start, a spur soon forms on the main stem, from which the system takes its name. It often becomes several inches in length and quite ungainly. This spur system of pruning is represented in Figs. 1741–3.

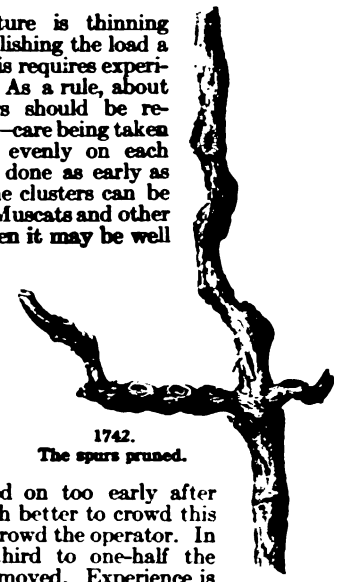


1741. Pruning to spurs. A long or old spur is shown on the left.

In the other system of pruning, known as the "long rod" or "long cane" system, a new cane is grown up from a bud near the ground every year to replace the old one, which is entirely removed. It is sometimes desirable to replace an old cane fruiting on the spur system in this manner. If the vine is well established, this new cane can be fruited its entire length the first season, the laterals being pinched, as before described. It will produce finer fruit, but it is not so safe with a heavy load as an old cane.

An ample supply of water judiciously and freely used, especially at the time of starting the vines, is an absolute necessity. It should not be applied in the house, however, during the period of blossoming, as a dry air is advantageous for the transfer of the pollen for fertilization.

An important feature is thinning the clusters and establishing the load a vine has to carry. This requires experience and judgment. As a rule, about one-half the clusters should be removed,—often more,—care being taken to balance the load evenly on each side. This should be done as early as the general form of the clusters can be seen, except with the Muscats and other shy-setting kinds, when it may be well to wait for the berries to set, as some clusters set perfectly while others fail.



1742. The spurs pruned.

Thinning the berries should be attended to promptly, selecting cool days and mornings for this work. Close-growing kinds, like Alicante, cannot be commenced on too early after setting, and it is much better to crowd this work than to have it crowd the operator. In many varieties one-third to one-half the berries have to be removed. Experience is the only guide in this. A pointed stick is very useful with the vine scissors, and never touch the clusters with the fingers.

Tying up the shoulders of the clusters is necessary to permit a free circulation of air and light, otherwise the interior may decay, and, once started, the cluster is soon gone. The principal diseases or troubles to guard against are mildew and red-spider. The remedy for the former is sulfur, and for the latter moisture. Mildew is generally brought on by a sudden change of temperature. A vigorous condition of the vine has much to do in resisting it. Red-spider will almost always appear in the hot weather of July and August if the vines are allowed to become too dry.

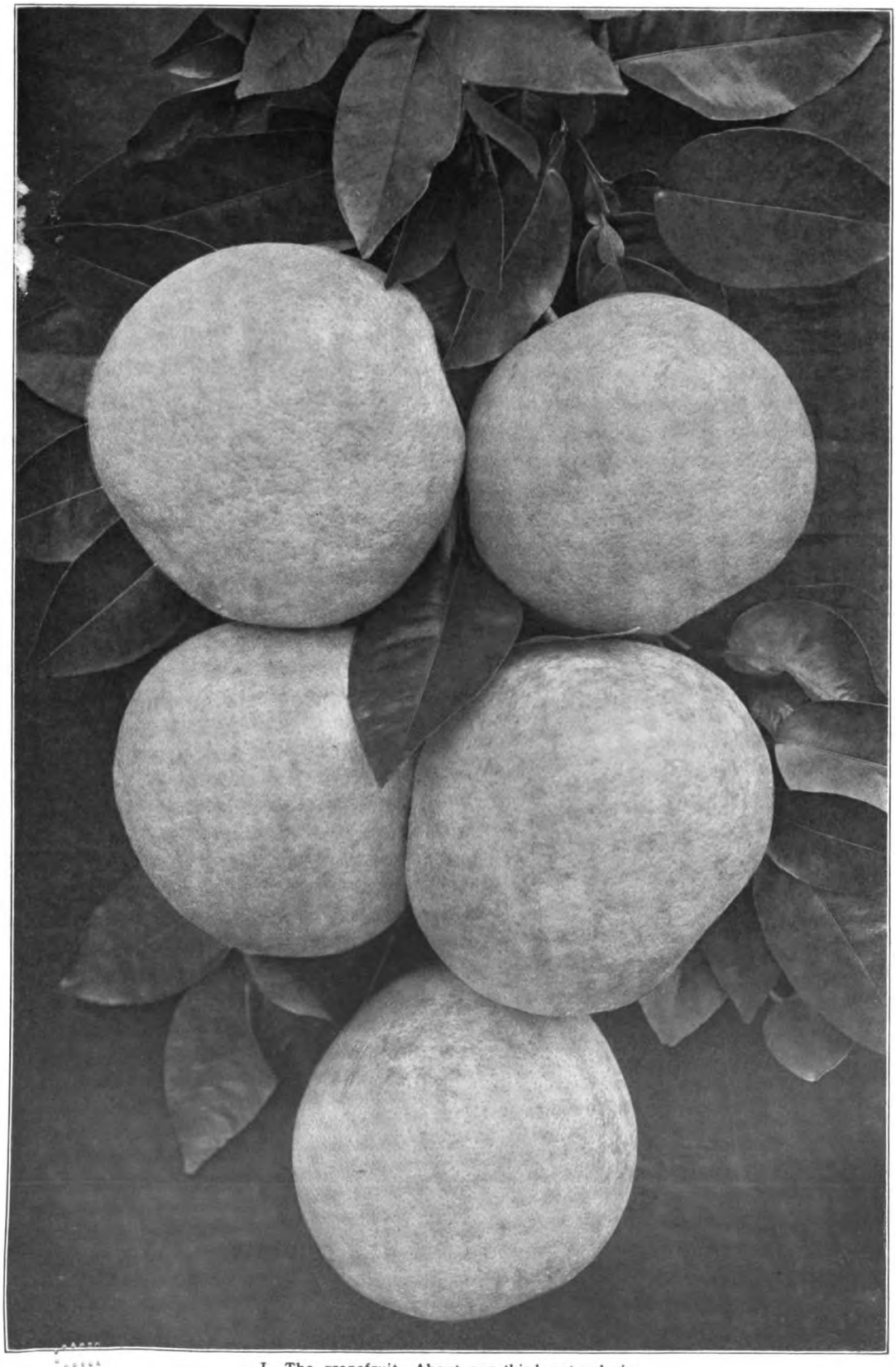
Thrips are sometimes very injurious, but can be controlled with nicotine, which, if properly applied, will not injure the fruit. Thrip and red-spider, if not taken in time, multiply rapidly, and "an ounce of prevention is worth a pound of cure" in these cases.

Perhaps, in a general way, the most important requisite of all is a large amount of enthusiasm and love for the work. This is necessary to insure the continued care and culture requisite to permanent success.

The fruit varieties.

As said before, very many varieties exist, but probably not one-half of these are in active cultivation at the present time. Varieties are adapted to localities, soils, climates, and the like. Perhaps fifty have been grown under glass in this country. Of these we will consider a few of the more prominent.

The Black Hamburg is more extensively grown and of more value for this purpose than all others put together, because it meets the requirements of the ordinary cultivator and will stand abuse and neglect and still give fair results, better than any other kind. It rarely gives very large clusters, but is a free bearer, sets fruit perfectly, will carry heavy loads and matures early. Under better care the appearance and improvement in quality is remarkable, and it can be made as good as the best. It is the variety with which the novice begins. Many houses consist entirely of Black Hamburgs, and many would give far better satisfaction if they did.



L. The grapefruit. About one-third natural size.

Muscat of Alexandria is the best of the white varieties for general cultivation. It requires a higher temperature and longer season than the Black Hamburgh to come to perfection, and will keep longer after cutting than that variety. When well grown and ripened it may be taken as a standard of quality. (See Fig. 1743.)

Muscat Hamburgh is a black grape, probably a cross between the two above-named varieties, and presenting marked characteristics of each. It has beautiful tapering clusters of fine quality.

Barbarossa is a good variety for those ambitious to grow large clusters and when well grown is of fine quality. It is a late black grape, requiring a long season to ripen well, but repays for the trouble by keeping thereafter for a long time. Clusters frequently grow to 8 or 10 pounds in weight, measuring about 24 inches each way, and they have been grown to more than double this weight.

Other large-growing varieties are the White Nice and Syrian, the latter of which is said to be the kind that the spies found in the land of promise. Clusters of 20 to 30 pounds weight are common to these two coarse-growing kinds, but their quality is so poor that they are now rarely grown.

Grizzly Frontignan is a beautifully mottled pink grape,—quite a deep pink sometimes,—and has long, slender clusters. In quality and flavor it is unsurpassed by any other grape, and it ripens quite early.

Royal Muscadine is an early white grape of fair quality and good habit quite common in English houses.

Gros Colman, a large black grape of fine quality and a late keeper, is now grown largely for commercial purposes in England and sent to this side to supply our wants in this line in spring. The berries frequently measure 4½ inches around, and it therefore requires early and severe thinning.

Alicante is a black grape of very distinct character, seeming to depart somewhat from the vinifera type, very juicy, and of fair quality. It has a very thick skin, and is about the best for long keeping.

Lady Downs is another late black grape of good quality, but not adapted to all localities. Rose Chasselas, a small red grape, is the earliest and very beautiful. Trentham Black, the earliest black grape, has small clusters, but large, soft berries quite like Alicante. Foster Seeding is a beautiful midseason, amber-colored grape, with large clusters and berries sometimes liable to crack. Madresfield Court Muscat is a midseason grape—fine in quality, but also inclined to crack. This trouble can often be controlled by twisting or slitting the stems of the clusters, thereby checking the flow of sap.

D. M. DUNNING.

1743. Muscat of Alexandria, bearing on spurs (as explained in Figs. 1741, 1742).

GRAPEFRUIT (*Citrus grándis*). *Rutaceæ*. Figs. 975, 1744. Plate L. A large globose fruit having slightly bitter acid pulp; it is used as a breakfast fruit and also for salads and desserts. It is grown in Florida, California, Arizona, and the West Indies, and is now extensively used by Americans. The name grapefruit, under which this fruit is known commercially, seems to have come from the West Indies and owes its origin to the fact that the fruits are often borne in clusters of three or four to twelve or more, much like a bunch of grapes. This fruit is also known as pomelo. The shaddock or pummelo is a distinct strain, not grown for commerce in this country. See *Citrus* (page 782) and *Pomelo*.

Grape fruit trees are large round-topped, with regular branches: lvs. dark glossy green, ovate with broadly winged petioles: spines slender, flexible, borne in the axils of the lvs.: fls. large, white, borne singly or in clusters in the axils of the lvs.; stamens 20–25; ovary globose, sharply set off from the style, which is deciduous: fr. pale lemon-yellow, flattened spheroid or globose, 4–6 in. diam., segms. 11–14, filled with slightly bitter acid pulp; seeds large, flattened and wrinkled; peel ¼–½in. thick, with numerous oil-glands.

The grapefruit appears to have been introduced into Florida by the Spaniards in the early part of the sixteenth century and until a quarter of a century ago it was grown only by the Florida pioneers. Since its culture has been undertaken on a commerical basis, the acreage planted to this fruit has rapidly increased, 1,061,537 boxes having been produced in Florida in 1909 as compared with 12,306 in 1899, and 122,515 boxes in California in 1909 as compared with 17,851 boxes in 1899. The total value of the crop in 1909, as reported by the Census, was over $2,000,000.

An excellent appetizer, the grapefruit is the most popular of breakfast fruits. It is also probable that it possesses valuable tonic properties, and it has been recommended by physicians in cases of malaria and biliousness. The sprightly flavor of the fruit, due to its slightly bitter principle, makes the grapefruit one of the most refreshing of all citrous fruits.

The grapefruit is more susceptible to cold than ordinary citrous fruits and its profitable culture is consequently restricted to regions below the frost line. The selection of a location is a matter of supreme importance in Florida where the occasional freezes have wrought so much damage in the past. The grapefruit, like most citrous fruits, prefers a light, well-drained soil, sandy or porous, though, because of its dense foliage, it grows better on poor soil than does the orange. The trees must be well fertilized in order to produce the best results, for it must be remembered that the care and fertilizer given are important factors in determining the quality and character of the fruit produced. Budded trees usually begin to bear in three to four years and generally reach full bearing in about ten years. They continue to bear for an indefinite period. The trees may be set from 18 to 25 feet apart, depending upon the stock on which they are grown. The seedlings make excellent stocks because of their well-developed root-systems and are extensively used for this purpose. They are hardier than the rough lemon but not so hardy as the orange. Grapefruits are usually propagated by budding because of the variations in the different varieties.

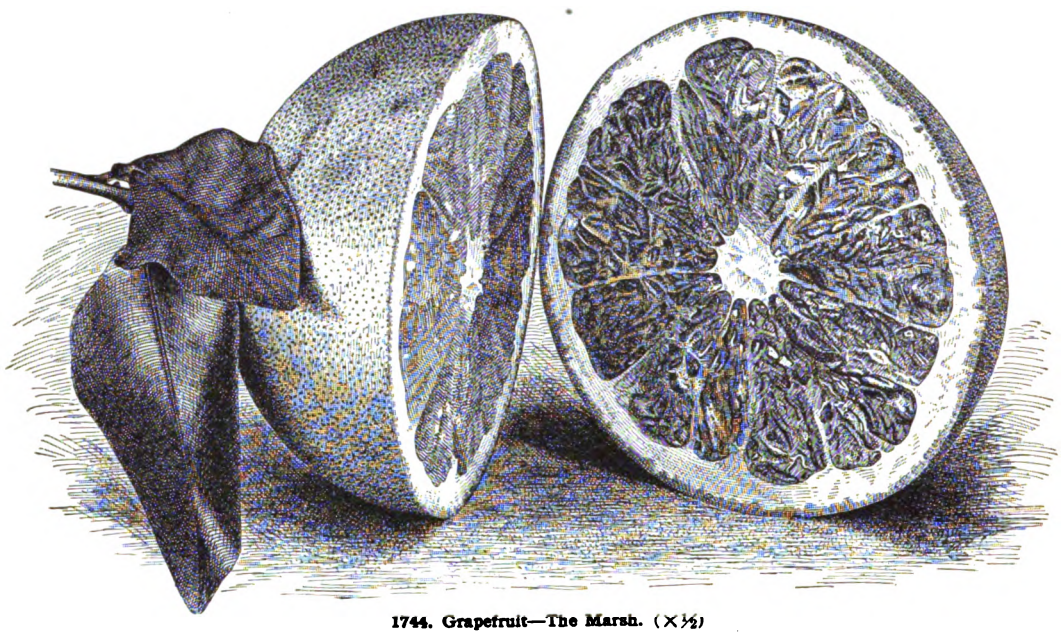
One of the most extensively grown varieties in Florida is the Duncan: fruits medium to large, oblate, light yellow; pulp a pleasant bitter acid flavor with few seeds; peel medium, firm; a late bearer, fruits keep well on the tree. The Duncan is one of the hardiest grapefruits, especially when budded on trifoliate orange stock (*Poncirus trifoliata*). Among others grown in Florida are Hall (Silver Cluster): fruits yellow, pleasantly bitter, globose, medium to large, in large bunches; a heavy bearer. Pernambuco: fruits large.

smooth-skinned. Introduced from Pernambuco, Brazil, by the United States Department of Agriculture. Triumph: fruits medium size, heavy, smooth-skinned, not very bitter; a prolific and a strong grower, but rather tender; season early. The Bowen, Excelsior, Josselyn, Leonardy, Manville, McCarty, McKinley, May, Standard and Walters are Florida seedlings cultivated locally in that state.

In California one of the best varieties is the Marsh (Marsh Seedless): fruit large (see Fig. 1744), subglobose, light yellow, not very bitter, often seedless, tree low and spreading. This variety originated in Florida but is best adapted to California conditions. The popularity of the grapefruit in California has been increasing during the past few years and it seems certain that this fruit is destined to become one of the standard fruits of that state. It should be noted that in California the grapefruit is really a summer fruit; in Florida it is a winter and spring fruit.

Hybrids.—The tangelo, the result of a cross between the tangerine orange and the grapefruit (pomelo) is a striking new citrous fruit. The Sampson tangelo, obtained by the writer in 1897 by crossing the tangerine with the Bowen grapefruit, is the first of this new group of fruits to be grown commercially. Other tangelos are now being tested. See *Tangelo.*

Diseases.—The grapefruit tree is decidedly resistant to mal-di-gomma or foot-rot and is only slightly affected by scab. It is, however, more susceptible than any other citrous fruit to citrus canker. This disease was first discovered near Miami, Florida, in July, 1913, by E. V. Blackman. It is believed to have been introduced from Japan. In appearance somewhat similar to the scab, this disease has spread over a large area in southern Florida. It is very infectious and has been carried from one grove to another by wagons, birds, and other means. No remedy is known, and Florida growers, in order to check its spread, have been obliged to burn hundreds of infected trees. Investigators differ as to the cause of citrus canker. WALTER T. SWINGLE.



1744. Grapefruit—The Marsh. (×½)

Grapefruit, or pomelo, in California.

Pomelos have been grown for many years in California, but, although they succeed admirably, they have not been produced in a commercial way until within recent years. Even at present, the product is only a small fraction of that of the orange and lemon. Perhaps not more than 400 or 500 cars are annually shipped out of the state. All of the Florida varieties have been tested, many of them proving unsuited to the conditions. At present the Marsh, or Marsh Seedless as it is commonly called, is planted almost exclusively. The Triumph and the Imperial are also grown to some extent, while the Nectar and the Clayson are new varieties which are attracting attention.

But little attention has been paid to the handling of this fruit in California, and it is undoubtedly true that many of the seedling and miscellaneous varieties which have been inadvisedly put on the market have been very much inferior to Florida-grown pomelos. Usually, on account of the poor varieties grown, California pomelos are shipped mainly to Pacific and intermountain states where they do not come in such active competition with the Florida product. It is undoubtedly true, however, that certain varieties of the pomelo when well grown and intelligently handled are equal to the best Florida product. There is no reason why the production of pomelos in California should not be considerably increased. Growers, however, seem to fear an over-production and new plantings are at present quite small.

The pomelo, in its general growth, resistance to frost, propagation, culture, fertilizing, irrigation, and the like, is similar to the orange. The season in California is from February 1 until September 1. J. ELIOT COIT.

GRAPE HYACINTH: *Muscari botryoides.*

GRAPE, SEASIDE: *Coccoloba uvifera.*

GRAPTOPHÝLLUM (Greek words referring to the variegated foliage). *Acanthàceæ.* Tender shrubs, one of which is cultivated in a very few American conservatories for its variegated foliage, and is said to be very popular in India and the tropics.

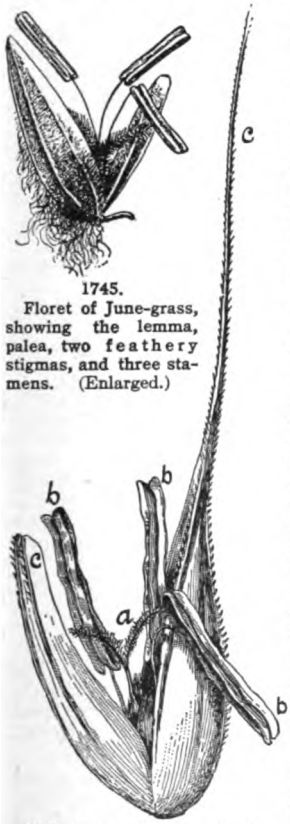
Leaves opposite, entire (in one species spiny-dentate), often colored: fls. reddish purple, wide gaping, clustered either in a terminal thryse or in the axils; calyx divided to the base into 5 segms.; corolla-tube inflated above; upper lip with 2 short recurved lobes; lower lip 3-cut; stamens 2: fr. a club-shaped or oblong caps.

—About 5 species, oriental. No two lvs. are marked exactly alike, but the yellow color is near the midrib rather than at the margins. The genus is close to Thyrsacanthus, but in Thyrsacanthus the fls. are not so distinctly 2-lipped. For cult., see *Justicia*.

horténse, Nees (*G. pictum*, Griff. *G. picturàtum*, Hort. *Justícia pícta*, Linn.). CARICATURE PLANT. Height finally 6–8 ft.: lvs. elliptic, acuminate, irregularly marked with yellow along the midrib: fls. crimson, in axillary whorls; corolla pubescent. Habitat (?). B.R. 1227. Lowe 45. B.M. 1870 shows a variety with reddish brown coloring.—A yellowish-fld. form has been offered under the name *G. picturatum*, but it does not seem to differ otherwise. N. TAYLOR.†

GRASS (*Graminex*). Annual or perennial, mostly herbaceous plants with usually hollow sts. (culms) closed at the joints (nodes), and 2-ranked lvs. Culms woody in the bamboos and in a few other groups such as the genus Lasiacis, sometimes solid as in maize: lvs. consisting of two parts, the sheath and the blade, the sheaths enveloping the culm above each node, the margins overlapping or occasionally grown together as in Bromus and Melica, the blades parallel-veined, usually linear or elongated (in some tropical grasses short and broad), on the inside bearing at the junction with the sheath a membranous or hyaline appendage or rim called the ligule; in some tropical grasses, especially bamboos, a petiole inserted between the sheath and blade: infl. paniculate or contracted into a raceme or spike, or more rarely into a head, the branches usually bractless; fls. usually perfect, sometimes monœcious as in maize, or dicœcious as in salt-grass (Distichlis), small, without a distinct perianth, arranged in spikelets consisting of a shortened axis (rachilla) and 2 to many 2-ranked bracts, the lowest pair (the glumes) empty, one or both of these sometimes absent; each succeeding bract (lemma) including a single fl. and, with its back to the rachilla, a 2-nerved bract or prophyllum (palea), the fl. with its lemma and palea being termed the floret; stamens usually 3, with delicate filaments and 2-celled versatile anthers; pistil 1, with a 1-celled, 1-ovuled ovary, usually 2 styles and plumose stigmas: fr. a caryopsis with starchy endosperm, and a small embryo at the base on one side; grain (caryopsis) inclosed at maturity in the lemma and palea (or sometimes exceeding these as in maize and pearl millet), adherent to the palea as in the oat, or free as in wheat. Figs. 1745–1748 show the structure of various grass florets.

1745. Floret of June-grass, showing the lemma, palea, two feathery stigmas, and three stamens. (Enlarged.)



1746. Floret of a grass (rye). *cc*, lemma and palea: *a*, stigmas: *bbb*, stamens. (Much enlarged.)

The lemmas are sometimes empty and are then termed sterile lemmas to distinguish them from the glumes. The spikelets may be inclosed in a spiny involucre or bur as in the sand-bur, or in an indurated shell as in Job's tears (Coix), or the entire spike in numerous husks as in maize.

The perennial species of grasses may produce creeping underground stems (rhizomes) by which they propagate. Kentucky blue-grass and awnless brome-grass are examples of this class. Such grasses usually form a sod. Those, such as orchard-grass, in which no rhizomes are produced usually grow in bunches or tussocks and are known as bunch-grasses.

The true grasses (*Graminex*) may be distinguished from other grass-like plants such as sedges (*Cyperacex*) and rushes (*Juncacex*) by the two-ranked leaves and the cylindrical or flattened stem. Sedges have three-ranked leaves and usually a triangular stem. There are also important differences in the floral structure. A. S. HITCHCOCK.

1747. Spike of a grass (rye), containing many spikelets.

1748. Staminate spikelet of a grass (maize), showing two flowers, one of which (with three stamens) is expanded. 1, 1, glumes; 2, 2, palea. (Enlarged.)

Uses of grasses.

Among the species most commonly known are timothy, redtop, June-grass, orchard-grass, meadow foxtail, the fescues, oat-grass, sweet vernal, quack-grass, Bermuda-grass, sugar-cane, chess, and the cereals, such as wheat, barley, rye, oats, rice, sorghum, Indian corn. In number of species the grass family occupies the fifth place with 3,500, while the compositæ, legumes, orchids and madderworts are larger. In number of individuals, the grasses excel any other family. Seed plants are arranged in 200 to 220 families, and of all these the true grasses are of greatest importance; in fact, they are of more value as food for man and domestic animals than all other kinds of vegetation combined. None of these families is more widely distributed over the earth's surface, or is found in greater extremes of climate or diversity of soil.

The species are very numerous in tropical regions, where the plants are usually scattered, while in a moist, temperate climate, although the species are less numerous, the number of plants is enormous, often clothing vast areas. Where soil is thin or moisture insufficient, the grasses grow in bunches more or less isolated. Plants of one section of the family, Panicaceæ, predominate in the tropics and warm temperate regions, while plants of the other section, Poaceæ, predominate in temperate and cold regions.

Overstocking dry grazing districts checks the better grasses, destroying many of them, and encourages the bitter weeds which multiply and occupy the land.

A grass extends its domain by running rootstocks, by liberating seeds inclosed in the glumes which are caught by the breeze, by some passing animal, or the nearest stream; the twisting and untwisting of awns bury some of them in cracks, crevices or soft earth. In case a growing stem is thrown down for any reason, several of the lower nodes promptly elongate on the lower side and thus bring the top into an erect position. Each sheath supports and holds erect the tender lower portion of the internode, where it is soft and weak; it also protects the young branches or panicles. Thrifty blades of grasses suitable for pasture and lawn elongate from the lower end, so that when the tips are cut off the leaves do not cease to elongate, but renew their length. When exposed to sun or dry air, the blades develop a thicker epidermis, and, by shrinking of some of the delicate bulliform cells of the upper epidermis, they diminish their surface as they roll their edges inward or bring them together, like closing an open book. When the plant is in flower the minute and delicate lodicules become distended just in time to spread the glumes and liberate the stamens.

Grasses are not so much employed for ornamenting homes as their merits warrant. By selecting, some can be found suited to every week of the growing season, though many of them are in their prime during June, the month of roses. Wild rice (Zizania) is fine for rich soil in the margins of ponds, and masses of reed grass for deep beds of moist muck. For massing or for borders the following and others are stately: *Arundo Donax*, *A. conspicua*, maize, pampas-grass, Eulalia, ribbon-grass, *Andropogon formosus*, *A. halepensis*, Hystrix, Tripsacum. For glaucous blue-green, use *Elymus arenarius*, *Festuca glauca*, and *Poa cæsia*. For potting and borders, there are striped varieties of Dactylis, Anthoxanthum, *Holcus lanatus*, *H. mollis*, *Poa trivialis*, *Phleum pratense*, and others may soon be produced. For table decoration nothing is better than the elegant, airy panicles of large numbers of wild grasses, such as species of Poa, Kœleria, Sphenopholis, Panicum, Paspalum, Eragrostis, Muhlenbergia, Bromus, Festuca, Agrostis, Deschampsia, Uniola, Briza, *Cinna latifolia*. For large halls and exhibitions, nothing surpasses sheaves of wheat, barley, rice, oats or any of the wild grasses. For decoration, grasses should be cut before ripe, dried in the dark in an upright position, and may be used in that condition or dyed or bleached. For paths, nothing is more pleasing than strips of well-mown lawn.

Drainage keeps out sedges and encourages the better grasses; manure and irrigation help the best grasses to choke and diminish most weeds. Enough has already been done to show that rich rewards are sure for him who patiently and intelligently attempts to improve grasses for any purpose whatever by selection and crossing. Quack-grass is excellent for holding embankments; *Ammophila arenaria* for holding drifting sands. The grass family furnishes its full quota of weeds, among them quack-grass, crab-grass, chess, June-grass, sand-bur, stink-grass.

Turf-forming grasses are those that spread freely by creeping rootstocks, such as June-grass, quack-grass, Bermuda-grass, Rhode Island bent and redtop, while most others are more or less bunchy. For northern regions not subject to severe droughts, sow Rhode Island bent and June-grass both, or either one alone; for certain regions, which are liable to suffer from dry weather, sow June-grass and plant Bermuda-grass. These two on the same ground supplement each other in different kinds of weather, securing a green carpet during every part of each growing season. W. J. Beal.

GRASSES, POPULAR NAMES OF. Few grasses hold commanding positions as specimen plants, although the agricultural values of grasses are transcendent. Some of the commoner vernacular grass names (not all of true grasses) are given with references to the proper genera: **Animated Oats,** *Avena*. **Artificial-G.,** sometimes used for certain forage plants, as sorghum, but also leguminous plants, as clover, lucerne, sainfoin. **Awnless Brome-G.,** *Bromus inermis*. **Beach-G.,** *Ammophila arenaria*. **Bear-G.,** unusual name for *Yucca filamentosa*. **Beard-G.,** *Andropogon;* also *Polypogon monspeliensis*. **Bengal-G.,** *Setaria italica*. **Bent-G.,** *Agrostis*. **Bermuda-G.,** *Cynodon Dactylon*. **Blue-eyed-G.,** *Sisyrinchium*. **Blue-G.,** *Poa*. **Bluejoint-G., Blue-stem-G.,** *Calamagrostis canadensis*, *Andropogon furcatus*, *Agropyron Smithii*. **Bog-G.,** *Carex*. **Bristly Foxtail-G.,** *Setaria magna*. **Brome-G.,** *Bromus*. **Canada Blue-G.,** *Poa compressa*. **Canary-G.,** *Phalaris canariensis*. **Cat-tail-G.,** *Phleum pratense*. **China-G.,** *Bœhmeria nivea*. **Citronella-G.,** *Cymbopogon*. **Cocksfoot-G.,** *Dactylis glomerata*. **Cotton-G.,** *Eriophorum*. **Couch-G.,** *Agropyron repens*. **Crab-G.,** *Eleusine* and *Digitaria sanguinalis*. **Crested Dog's-tail G.,** *Cynosurus cristatus*. **Deer-G.,** *Rhexia virginica*. **Dog's-tail-G.,** *Cynosurus*. **Eel-G.,** *Vallisneria spiralis*. **English Rye-G.,** *Lolium perenne*. **Esparto-G.,** *Stipa tenacissima*. **Feather-G.,** *Stipa pennata*. **Feather Sedge-G.,** *Andropogon saccharoides*. **Fescue-G.,** *Festuca*. **Finger-comb-G.,** *Dactyloctenium*. **Finger-G.,** *Chloris*. **Fly Away-G.,** *Agrostis hiemalis*. **Four-leaved-G.,** *Paris quadrifolia*. **Fowl Meadow-G.,** *Poa triflora*. **Golden-Top G.,** *Lamarckia aurea*. **Guinea-G.,** *Panicum maximum;* also erroneously used for *Holcus halepensis*. **Hair-G.,** *Agrostis hiemalis*. **Hare's-tail G.,** *Lagurus ovatus*. **Hassock-G.,** *Deschampsia cæspitosa*. **Herd's-G.,** in New England is timothy (*Phleum pratense*); in Pennsylvania, fiorin (*Agrostis alba*). **Holy-G.,** *Hierochloa borealis*. **Hungarian-G.,** *Setaria italica*. **Italian Rye-G.,** *Lolium multiflorum*. **Japanese Lawn-G.,** *Zoysia pungens*. **Job's-tears,** *Coix*. **Johnson-G.,** *Holcus halepensis*. **June-G.,** *Poa pratensis*. **Kentucky Blue-G.,** *Poa pratensis*. **Large Quaking-G.,** *Briza maxima*. **Little Quaking-G.,** *Briza minor*. **Love-G.,** *Eragrostis elegans*. **Lyme-G.,** of upholstery is *Deschampsia cæspitosa*. **Marram-G.,** *Ammophila arenaria*. **Myrtle-G.,** *Acorus Calamus*. **Oat-G.,** *Arrhenatherum elatius;* also various species of Avena. **Orchard-G.,** *Dactylis glomerata*. **Palm-leaved G.,** *Panicum sulcatum*. **Pampas-G.,** *Cortaderia*. **Pepper-G.,** *Lepidium;* also *Pilularia globulifera*. **Plume-G.,** *Erianthus Ravennæ*. **Pony-G.,** *Calamagrostis stricta*. **Purple Bent-G.,** *Calamovilfa brevipilis*. **Quack-, Quick-,** or **Quitch-G.,** *Agropyron repens*. **Quaking-G.,** *Briza*. **Rattlesnake-G.,** *Briza maxima;* also *Glyceria canadensis*. **Ray-G.,** *Lolium perenne*. **Redtop G.,** *Agrostis alba*. **Reed-G.,** *Arundo, Bamboo*. **Reed Bent-G.,** *Calamagrostis*. **Reed Canary-G.,** *Phalaris arundinacea*. **Rescue-G.,** *Bromus unioloides*. **Rhode Island Bent-G.,** *Agrostis canina*. **Ribbon-G.,** *Phalaris arundinacea* var. *picta*. **Rough Bent-G.,** *Agrostis hiemalis*. **Roughish Meadow-G.,** *Poa trivialis*. **Roughstalked Meadow-G.,** *Poa trivialis*. **Rye-G.,** *Lolium perenne*. **Sand-G.,** *Calamovilfa longifolia*. **Scurvy-G.,** *Cochlearia officinalis*. **Scutch-G.,** *Cynodon Dactylon*. **Seacoast Bent-G.,** *Agrostis alba* var. *maritima*. **Seneca-G.,** *Hierochloa borealis*. **Sesame-G.,** *Tripsacum*. **Sheep's Fescue-G.,** *Festuca ovina*. **Silk-G.,** *Agrostis hiemalis*. **Silver Beard-G.,** *Andropogon argenteus*. **Sour-G.,** local name for *Rumex Acetosella*. **Squirrel-tail-G.,** *Hordeum*. **Star-G.,** *Callitriche;* also locally for *Hypoxis* and *Aletris*. **Striped-G.,** *Phalaris arundinacea* var. *picta*. **Sweet-scented Vernal-G.,** *Anthoxanthum odoratum*. **Tall Meadow Oat-G.,** *Arrhenatherum elatius*. **Tickle-G.,** *Agrostis hiemalis*. **Tear-G.,** *Coix Lachryma-Jobi*. **Texas Blue-G.,** *Poa arachnifera*. **Timothy,** *Phleum*. **Tufted Hair-G.,** *Deschampsia cæspitosa*. **Vanilla-G.,** *Hierochloa borealis*. **Viper's-G.,** *Scorzonera*. **White Bent-G.,** *Agrostis alba*. **Whitlow-G.,** *Draba*, especially *D. verna*, and *Saxifraga tridactylites*. **Wood Meadow-G.,** *Poa nemoralis*. **Woolly Beard-G.,** *Erianthus*. **Worm-G.,** *Spigelia;* also *Sedum album*. **Yellow-eyed-G.,** *Xyris*. **Zebra-G.,** *Miscanthus sinensis*.

GRATÌOLA (Latin, *grace* or *favor*, from its reputed healing properties). *Scrophulariàceæ*. Low herbs, rarely planted.

Plants with opposite lvs.: fls. yellow or whitish, peduncled, axillary, hypogynous, perfect; calyx 5-parted, nearly regular; corolla gamopetalous, tubular-funnelform, more or less 2-lipped; upper lip entire or 2-toothed, lower 3-lobed; perfect stamens 2, the anterior pair wanting or rudimentary; ovary superior, 2-celled; style filiform; stigma dilated 2-lobed: fr. a 4-valved, many-seeded caps.—About 25 species in many parts of the world, none of which is of commercial importance. The following species has been advertised for sale and would make a good plant for covering the muddy borders of ditches and aquatic gardens. Most species are perennial.

aûrea, Muhl. GOLDENFERT. GOLDEN HEDGEHYSSOP. Annual, prostrate, viscid, puberulent or glabrate: lvs. lance-oblong, 2–12 lines long, denticulate, sessile by a broad base: fls. bright yellow, showy, 6–7 lines long. Wet sandy shores, Maine and Ont. to Fla., mostly along the coast. B.B. 3:162.

K. M. WIEGAND.

GRAVÈSIA (after C. L. Graves, who collected in Madagascar). *Melastomàceæ*. Dwarf warmhouse foliage plants, natives of Madagascar, and cultivated in a few American conservatories.

Flower parts in 5's or the stamens 10, all equal; petals obovate, obtuse or sometimes with a short spine-like process: fr. a 3-valved caps.—Three species. For cult. and for distinctions from allied genera, see *Bertolonia*, under which name most of the varieties are still known.

guttàta, Triana (*Bertolònia guttàta*, Hook.). Caulescent, erect: branches obtusely 4-angled: petioles 2½–3 in. long, densely scurfy-powdery: lvs. membranous, 5-nerved, rotund at base, slightly scurfy above and spotted, under side and calyx scurfy-powdery: cymes terminal, several-fld. Intro. 1865, and first described in B.M. 5524 as *B. guttata*, where the lvs. are shown with fairly well defined, double, longitudinal rows of roundish pink dots. F.S. 16:1696 is probably a copy of B.M. 5524. (See, also, Gt. 1865, p. 385, and B.H. 1865, p. 225.) Var. **supérba,** Hort., I.H. 26:359 (1879), is shown, with more and larger reddish purple spots, which are less regularly arranged. Var. **Legrelleàna** (*B. Legrelleàna*, Van Houtte). An alleged hybrid obtained by Van Houtte and figured in F.S. 23:2407. Coigneux refers this plate to *Gravesia guttata*, but no fls. are shown, nor have the lvs. any spots. The nerves are outlined in white, and some of the cross-veins for short distances. Var. **Alfred Bleu** is brilliantly spotted and lined with bright red, the nerves boldly outlined, the cross-veins interruptedly outlined. I.H. 41:13 (1894). Var. **margaritàcea,** Nichols. (*B. margaritàcea*, Hort. W. Bull=*Salpinga margaritacea*. F.S. 16:1697). See DC. Mon. Phan. 7:537.

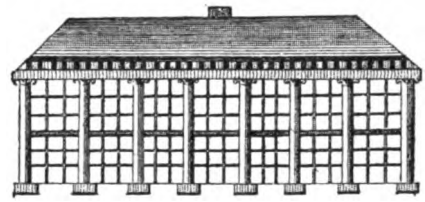
N. TAYLOR.†

GRAVÌSIA (the name unexplained). *Bromeliàceæ*. South American acaulescent herbs, differing from Æchmea in the character of the pollen-grains and other technical features, and requiring similar treatment in cult. Lvs. densely rosulate, conspicuously sheathing, brown-scurfy, the margin more or less spiny: scape arising from the center of the rosette, bearing a panicled or bipinnate infl.: petals yellow or orange. **G. exsûdans,** Mez (*Æchmèa exsùdans*, Baker. *Tillándsia exsùdans*, Desf. *Bromèlia exsùdans*, Lodd. *Hohenbérgia capitàta*, R. & S.) Fls. congested in sessile heads composing a compound panicle, the floral bracts spine-pointed: lvs. whitish beneath, oblong, spiny. L.B.C. 9:801.—Fls. said to exude a whitish greasy substance, whence the name. Plant 2–3 ft. Apparently very little grown.

L. H. B.

GREENHOUSE. In America the word greenhouse is used generically for any glass building in which plants are grown, with the exception of coldframes and hotbeds. Originally and etymologically, however, it means a house in which plants are kept alive or green: in the greenhouse plants are placed for winter protection, and it is not expected that they shall grow. The evolution of the true greenhouse seems to have begun with the idea of a human dwelling-house. At first larger windows were inserted; and later, a glass roof was added. In early times it was thought best to have living-rooms above the greenhouse, that it might not freeze through the roof. Even as late as 1806, Bernard M. Mahon, writing in Philadelphia, felt called upon to combat this idea. The old or original conception of a greenhouse as a place for protecting and storing plants is practically extinct, at least in America (Fig. 1749). In England, the word greenhouse is mostly used for a house or structure in which are kept or grown those plants that do not require a very high temperature.

Other types of plant-houses are the conservatory (which see), in which plants are kept for display; the forcing-house (see *Forcing*), in which plants are forced to grow at other times than their normal season; the



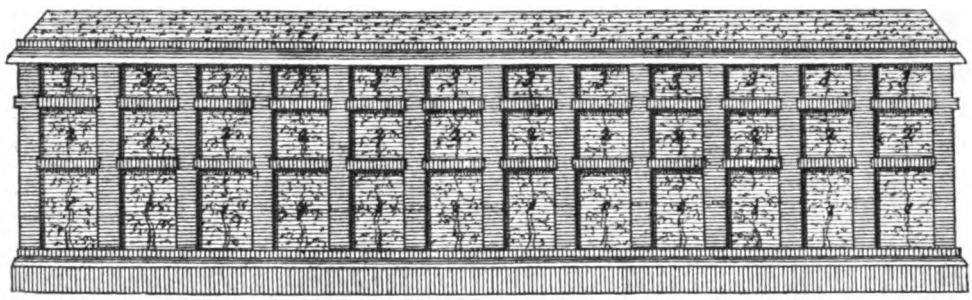
1749. The old-time greenhouse with opaque roof and sash-made sides (Abercrombie, 1786).

stove or warmhouse; the propagating-pit. Originally the warmest part of the plant-house, that part in which tropical plants were grown, was heated by a stove made of brick, and the house itself came to be called a stove. This use of the word stove to designate the warmest part or room of the range is general in England, but in America we prefer the word warmhouse (and this word is much used in this Cyclopedia). Originally, hothouse was practically equivalent to stove, but this term is little used in this country, and when used it is mostly applied generically in the sense of greenhouse.

It will thus be seen that there is no one word that is properly generic for all glass plant-houses. The word glasshouse has been suggested, and it is often used in this work; but there are other glass houses than those used for plants. It seems best, therefore, to use the word greenhouse for all glass buildings in which plants are grown; and American usage favors this conclusion.

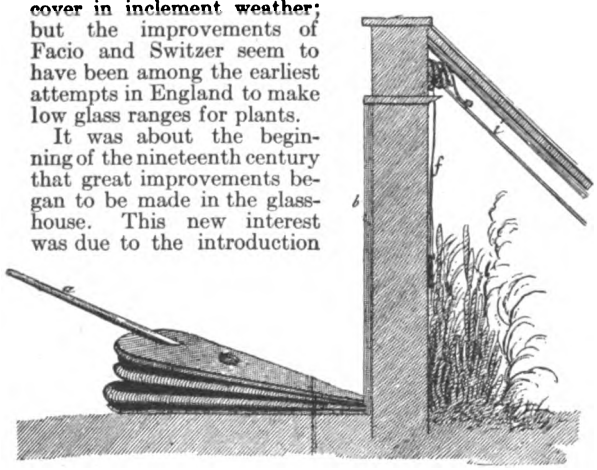
The long, low greenhouse range, of the type we now know in our commercial establishments, probably had a different origin from the high-sided greenhouse. The glasshouse range appears to have developed from the practice of protecting fruits and other plants against a wall. In European countries, particularly in England, it is the practice to train fruits and other plants on stone or brick walls, that they may be protected from inclement weather and receive the greater sun heat that is stored in the masonry. It occurred to Nicholas Facio Duilhier to incline these fruit walls to the horizon so that they would receive the greater part of the incident rays of the sun at right angles. He wrote a book on the subject of "Fruit-Walls Improved," which was published in England in 1699. Facio was a mathematician, and he worked out the principle of the inclined walls from mathematical considerations. Such walls were actually built, but according to the testimony of Stephen Switzer, who wrote in 1724, these walls were not more successful than those which stood perpendicularly. Certain of these walls on the grounds of

Belvoir Castle, and over which grapes were growing, received the additional protection of glass sash set in front of the inclined walls and over the vines. In addition to this, flues were constructed behind the wall in which heat might be supplied. The construction of hollow heated walls was not uncommon in that day. The satisfactory results that followed this experiment induced Switzer to design glass-covered walls. The "glasshouse" which he pictured in the "Practical Fruit-Gardener" (1731) represents a greenhouse 3½ feet wide in the clear (Fig. 1750). At the back of this house is an inclined heated wall on which the grapes are grown. Three and one-half feet in front of this a framework is erected to receive the sash. There are three tiers of openings or windows along the front, the two lower ones of which are for window-sash, and the upper one is vacant in order to provide for ventilation and to allow space to receive the lower sash when they are lifted up. The whole structure is covered with a roof or coping. Switzer declares that the introduction of these covered sloping walls "led the world" to the "improvement of glassing and forcing grapes, which was never done to that Perfection in any Place as it is upon some of the great Slopes of that elevated and noble Situation of *Belvoir Castle*." Johnson, in his "History of English Gardening," quotes the remarks of Switzer, and makes the statement that the use of these walls "led to the first erection of a regular forcing structure of which we have an account." The immediate outcome of these covered walls seems to have been the lean-to greenhouse, and from that structure has perhaps developed the double-span glass range of the present day. Long before Switzer's time plants were forced in a crude way, even by the Romans, mostly by being placed in baskets or other movable receptacles, so that they could be placed under cover in inclement weather; but the improvements of Facio and Switzer seem to have been among the earliest attempts in England to make low glass ranges for plants.



1750. Switzer's glasshouse, built on an inclined wall (1731).

It was about the beginning of the nineteenth century that great improvements began to be made in the glasshouse. This new interest was due to the introduction of new plants from strange countries, the improvement of heating apparatus, and the general advance in the art of building. The ideals that prevailed at the opening of the century may be gleaned from J. Loudon's "Treatise on Several Improvements Recently Made in Hot-Houses," London, 1805. One of the devices recommended by Loudon will interest the reader. It is shown in Fig. 1751. The bellows is used for the purpose of forcing air into the house, that the plants may be supplied with a fresh or non-vitiated atmosphere. "By forcing the air into the house, once a day or so, double the quantity of air which the house usually contains" can be secured. The house could be "charged." The tube leading from the bellows is shown at *b;* it discharges at *c*. Curtains run on wire, *i;* the curtain cord is at *f*.



1751. Loudon's device for charging a greenhouse with air.

Greenhouses are now built on the plan of the long low glass range with sides varying from 5 feet 6 inches to 7 feet in height. The tendency in commercial structures is for a height of 7 feet from ground to eaves. The taller glass structures are used for conservatory purposes, housing such table plants as palms, tree-ferns, or the like, or when an architectural feature is desired. The general tendency of the building of glass structures is toward extreme simplicity (Fig. 1547, p. 1256). In the extreme South, lattice-work buildings are sometimes used for the protection of plants, both from light frosts and from the sun (Fig. 1752). The heating now employed in this country is of three different kinds: hot water under very low pressure or in the open-tank system; hot water in practically closed circuits; and steam. Hot water under low pressure is an old-time mode of heating, and is not now popular in this country except for conservatories and private establishments. The heavy cumbersome pipes are not adapted to laying over long distances and under varying conditions. The commercial houses are now heated by means of wrought-iron pipes, which go together with threads. The comparative merits of steam and hot water in these wrought-iron pipes are much discussed. For large establishments, hot water under pressure is now employed to some extent. Much progress has been made in methods of heating in recent years, and either steam or hot water gives good results when competently installed. The merits of one system or the other are very largely those of the individual establishment and apparatus, and the personal choice of the operator (see page 1403; also pages 1400 and 1402).

The simple straight and direct house is now much in favor with the commercial growers of carnations, chrysanthemums, violets, roses, vegetables, and with propagators. Most of the greenhouse construction firms are designing houses most admirably adapted to the growing of these plants. Each firm has a few original forms worked into the detail plans, calculated to appeal to the growers' fancy. Perhaps the ideal structure for carnations, for example, is a single detached house, about 50 feet wide and 500 feet or less in length, with ventilators on each side of the ridge and on each side below the eaves, and the eaves, or the gutters, 6 feet above the grade.

With the refinements of architecture and the growth of satisfaction in home-building, the glasshouse is

becoming an integral part of the residence. Sometimes it takes the form of a sun-parlor, and in which certain plants may be kept at least temporarily; sometimes it is a real plant-house added to the residence, a glass or covered garden that carries bloom and verdure through the cold weather and enables the homemaker to span the year. The best results in plant-growing are secured when the structure is separate, with its own heat, its normal exposure, and its own essential set of conditions; but it is worth while to add a garden-room to a residence even if the horticultural results are not great. Some of the architectural combinations of glass and other materials are very artistic and interesting.

L. H. B.

Greenhouse construction.

For convenience, this subject may be considered under the following heads; i. e., *Location, Plans, Grading, Foundations, Framework, Glazing and painting, Plant-tables, Ventilation, Heating.*

Location.

Greenhouses which are intended for use in connection with the gardens should be placed, for convenient attendance, within the garden inclosure or along its boundary. A good location for the garden will usually be found the best one for the greenhouse.

A conservatory or greenhouse designed for a private place, where specimen and blooming plants will be kept for the pleasure of the family and entertainment of visitors, should be attached to the dwelling or located as near as possible in a well-kept part of the grounds. A conservatory does not require a full southern exposure. Most decorative plants thrive as well or better and continue in bloom for a longer time if kept in a house having plenty of light, but so located as to receive but little direct sunlight. Large ranges of glass adapted to a variety of purposes are generally kept separate from other buildings. In parks the location should be near a main entrance.

The location of a range of glass for commercial purposes, where the elements of expense and profit are to have the first consideration, is of great importance. The chief items that determine the desirability of a suitable location are the adaptability and value of the land, cost of fuel delivered, ample and inexpensive water supply and proximity to a market. The top of a bleak hill and the bottom of a valley should both be avoided. Level land, or that having a southerly slope, is the best.

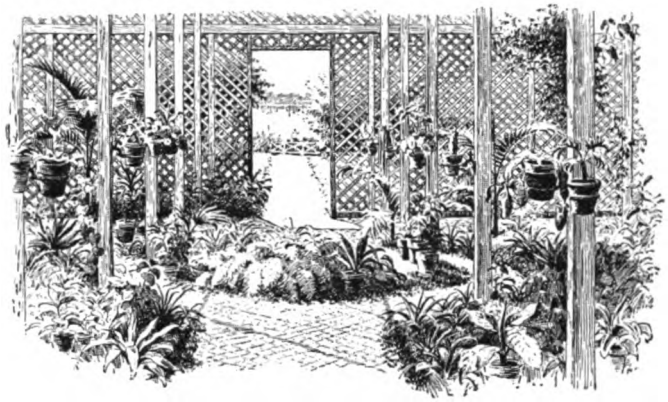
Plans.

When a site for the proposed greenhouse has been decided upon, full plans should be made before commencing to build. The plans should embrace not only the glass, which is required at once, but should provide for the largest increase which can be anticipated. In this way houses can be erected which are convenient to work and have a good appearance, with small extra cost for building only part at a time. Attention should be given to the special peculiarities of the location, like the exposure to the sun, grade of ground, shape of lot and best location for the heating apparatus. Each compartment should have the proper form of house and exposure to the light adapted to the plants for which it is provided.

It will readily be seen that to locate and plan a range of glass to the best advantage requires skill and experience. In a communication received by the writer from a superintendent of one of the most important botanic gardens in the country, it was remarked that "when the architect prevails, the gardener fails." It is also true to a greater degree than in almost any other class of buildings that the beginner or amateur who undertakes to plan and construct his own greenhouse is likely to pay well for his experience, and will at least sympathize with the "lawyer who pleaded his own cause and found he had a fool for a client." This is perfectly true, as many know to their cost. To plan a greenhouse satisfactorily, the designer must have a practical knowledge of the requirements. To meet this increasing demand, specialists can be found, known as "horticultural architects," who devote their entire time to this branch of work.

Grading.

The floor of the greenhouse should be a few inches above the outside grade. As most greenhouses are necessarily built low to accommodate the plants, a small terrace around them adds to the elevation and the good appearance of the structure. It will usually be best to keep the floor of a greenhouse all on one level. When the variation in the grade of the ground is not too great, the floor line should be at the highest point of the grade. In the case of a long house, the floor line is sometimes made the same as the natural grade, but such an arrangement is to be avoided when possible. For locations on a hillside, the different apartments may have different floor-levels, with necessary steps between them.



1752. A lattice-covered plant-house.

All the sod and loam should be removed from the space to be covered by a greenhouse and all the filling necessary made with subsoil. The latter should be laid in thin layers and each wet down and thoroughly tamped. Loam used for filling under a greenhouse is likely to become sour, and will continue to settle for a long time, causing much trouble and annoyance.

Foundations.

Too much care cannot be given to the preparation of good foundations. These are usually of brick, but may be made of stone or concrete. The brick walls take up less room in the house than stone, and are usually less expensive. The foundation walls should be extended down to a point below the frost line, generally 3 or 4 feet deep, and are usually raised about 2 feet above the grade. An inexpensive wall of rubble stone work or of concrete is all that is needed in the ground. The part of the wall showing above grade may be of plain brick, or brick faced with stone, or the entire wall may be built of concrete finished with cement plaster. It is usual to construct the walls of the same material as the surrounding buildings, or with some material that will harmonize with them. Until a few years ago, double boarding was used exclusively for the side walls in greenhouses built by florists, the rafters being car-

ried into the ground about 30 inches. Today, light concrete walls about 4 inches thick are built. The cost of the concrete is almost the same as double boarding but has the advantage of being indestructible.

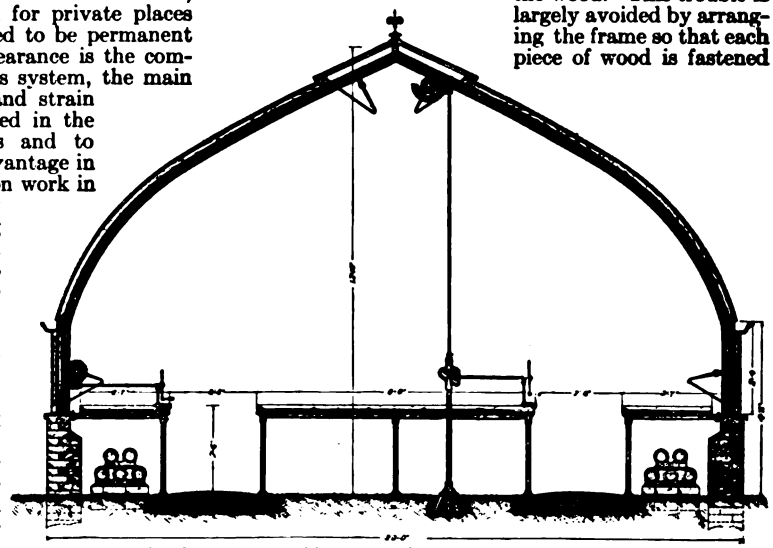
Framework.

The construction best adapted for conservatories, park houses and greenhouses, and for private places where the improvements are desired to be permanent in character and attractive in appearance is the combination of iron and wood. In this system, the main frame which supports the weight and strain is of iron, or steel, wood being used in the frames as a setting for the glass and to form a non-conductor of great advantage in the heating of the house. The iron work in this style of construction usually consists of cast-iron sills capping the foundation walls, wrought-iron rafters setting on the sills, about 8 feet apart and running from sill to ridge, forming the side post and rafter in one piece, cast-iron gutters, and angle iron purlins between the rafters, all securely bracketed and bolted together, forming a complete framework of metal, light, strong and durable. The wood used consists of light sash-bars for supporting the glass, sashes for ventilation and doors. This woodwork being entirely supported by the metal frame, and not being used where it will be continually wet, will be found as durable as any other material, and for many reasons better adapted for the requirements of a greenhouse roof. This combination system of metal and wood construction has been extensively adopted by florists, growers of cut-flowers and also the progressive vegetable-growers. In the houses built for the above, the masonry foundation walls are omitted. Posts constructed of wrought-iron are placed in the sides extending from about 30 inches below grade to the height of the eaves. These posts occur at every rafter, to which they are connected with steel or cast-iron fittings. The posts are embedded in concrete below grade, and 4-inch concrete walls built extending from 6 inches below grade up to the under side of the glazing sill.

Gutters are seldom used at the eave line in this type of house. An angle-iron eave-plate is substituted for the gutter so framed as to allow the snow and ice to slide over it, keeping the roof entirely clear from such accumulations which darken a house in winter.

The first cost is somewhat increased over an all-wood construction, but in view of its greater durability and saving in repairs, it will be found in the end, the better investment.

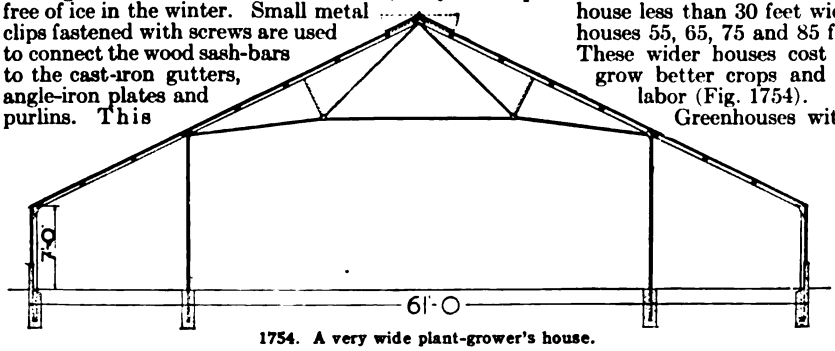
Cast-iron gutters are provided to collect the rain-water from the roof. By exposing the inner side of these gutters to the heat of the house, they are kept free of ice in the winter. Small metal clips fastened with screws are used to connect the wood sash-bars to the cast-iron gutters, angle-iron plates and purlins. This method of securing the sash-bars in place is very convenient in case of repairs, and renders the structure practically portable. A careful examination of any old greenhouse will show that the parts of the frame which decay first are those pieces of wood which are joined together, for water penetrating the joints soon destroys the wood. This trouble is largely avoided by arranging the frame so that each piece of wood is fastened directly to the iron frame instead of to another piece of wood. Joints between wood and iron do not rot the wood, the latter being preserved by the corrosion of the metal.



1753. Even-span curvilinear greenhouse, with cast-iron piping.

The curvilinear form of house (Fig. 1753) is ornamental and particularly well adapted for conservatories, palm-houses and show-houses of all kinds. It is preferred for vineries and fruit-houses, as the form allows the canes to be supported on the line of the roof without a sharp bend at the plate line. The light in a curved house, being admitted at different angles, is better diffused and more natural than when reflected through a long pane of straight glass. The cost of a curved roof is slightly greater in the construction, but the arched frame is stronger and will keep its shape better than a house with straight lines, thus largely compensating for the extra cost. For special purposes and locations, special forms of frames may be used. Good forms of commercial houses are shown in Figs. 1754–56.

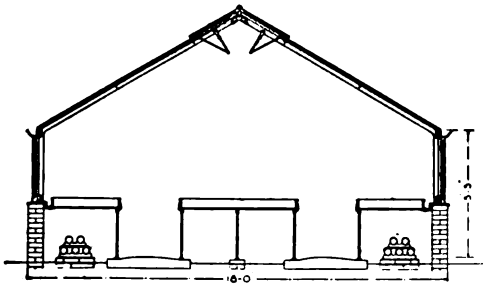
The ridge-and-furrow type of house (Fig. 1757) is seldom built now except in cases in which the amount of land available is limited. The superior growing qualities of greenhouses built separately has been thoroughly demonstrated, as has also the increased productiveness of wide houses. A florist now seldom builds a house less than 30 feet wide. It is oftener 40 feet, and houses 55, 65, 75 and 85 feet wide are not uncommon. These wider houses cost less in proportion to build, grow better crops and are more economical as to labor (Fig. 1754).



1754. A very wide plant-grower's house.

Greenhouses with curved eaves (Fig. 1756) are being built more and more. This type presents a pleasing appearance and eliminates shade-casting members at the eaves. A combination sill and gutter is substituted for the plain sill on top of masonry wall to which the rafters and bars are secured.

It is commonly admitted that the so-called "sash-bar construction" is not the best or lightest method of construction, but as the absence of most of the framing reduces its cost so that it is the cheapest to build, it remains a popular method of putting up a commercial

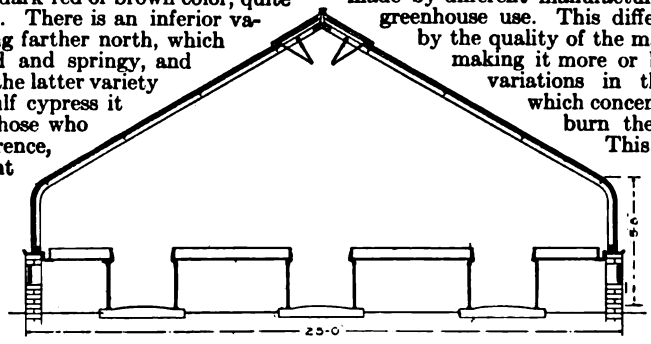


1755. A compact two-walk house.

greenhouse. Circulars showing the various methods adopted by the dealers in greenhouse material can readily be secured by applying to them.

The best wood to use for greenhouse framework and plant-beds is undoubtedly cypress. In purchasing this lumber, care should be taken that only that grown in the states bordering on the Gulf of Mexico be selected. This will be found of a dark red or brown color, quite soft and easily worked. There is an inferior variety of cypress growing farther north, which is light in color, hard and springy, and likely to be shaky. As the latter variety is cheaper than red Gulf cypress it is frequently used by those who do not know the difference, to the serious detriment of the work and the loss of reputation of cypress for such purposes.

In the market there are three grades of cypress lumber, and it is important to know which to choose. The best grade is known as "firsts and seconds," and calls for lumber with a small extent of sap on the edges and occasionally a small sound knot. This is the quality which should be ordered for all the framework of the roof, sash-bars, and so on. In order to make the material entirely free from sap there will be a waste in cutting up this quality of 10 to 20 per cent. The second grade is known to the trade as "selects." This name indicates that it has been graded so that one face of each piece of lumber is of about the same quality as the "firsts and seconds," the other face generally being largely sap. This quality is fit only for outside boarding in greenhouse construction; it has too much sap. The cost is usually about five dollars a thousand less than the best grade. As it looks to the inexperienced eye almost the same as the best grade, too much of it finds its way into greenhouse structures. Such sap lumber usually will not last more than two to five years. Too great care cannot be exercised to avoid its use. The third grade of cypress lumber is termed "cutting up," and is so called because it embraces all the pieces which have imperfections, such as large knots and splits, which bar them from the better grades. This is a good quality to purchase for base-boards and plant tables, for by cutting out the sap and objectionable knots it will be found satisfactory for these purposes. The "cutting up" grade costs about ten dollars less a thousand than the "firsts and seconds." The percentage of waste in cutting up will be somewhat greater than in the other grades. Cheap timber is likely to give unsatisfactory results in greenhouse work.



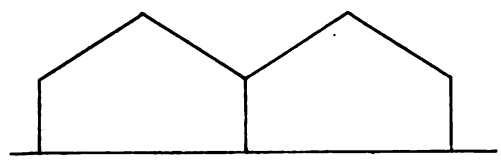
1756. Section of curved-eave house.

Cypress lumber which has been in use for gutters, sash-bars, plates, and the like, in greenhouses where high temperatures have been maintained is still, after many years, apparently in as good condition as when first used. Owing to the porous texture of the wood, the paint, when applied, sinks in and does not make so fine a coat as on some other woods, but because of this fact the paint adheres to the wood better and lasts longer.

Glazing and painting.

Ordinary sheet or window glass is in general use for greenhouse glazing. It is better to use only the thickness known to the trade as "double-thick." This weighs from twenty-four to twenty-six ounces a square foot. The thickness known to the trade as "single thick" weighs only about sixteen ounces to the square foot, and is entirely too frail for the purpose. There is very little difference at present in the quality of the imported French or Belgian and the American glass. The weight of most of the glass of American manufacture is about 2 ounces greater a foot than the imported, and therefore it is proportionately stronger. This greater strength is of considerable importance in the additional security which it affords from damage caused by that enemy of the florists, the hail-storm. There is a great difference in the quality of the glass made by different manufacturers in its adaptation to greenhouse use. This difference is caused chiefly by the quality of the material used in the glass, making it more or less opaque, and in the variations in thickness causing lenses which concentrate the sun's rays and burn the foliage of the plants. This last defect in the glass cannot be wholly guarded against, as the product of a factory does not always run the same so that any favorite brand cannot be fully relied upon in this respect. The waves which burn will be found in all the different grades of glass, firsts, seconds and thirds, with little, if any difference, the grading being done chiefly for other defects, such as affect the value of the glass for window purposes. For these reasons, in selecting the glass for a greenhouse, it requires experience to decide what make of glass it will be best to purchase. It will be well to purchase from someone who makes a specialty of furnishing glass for greenhouses or call in the aid of some friend who has had experience in building, and can give intelligent advice.

The second quality of glass is usually selected for the best greenhouse work. The standard widths are from 12 to 16 inches, and lengths vary from 16 to 24 inches.



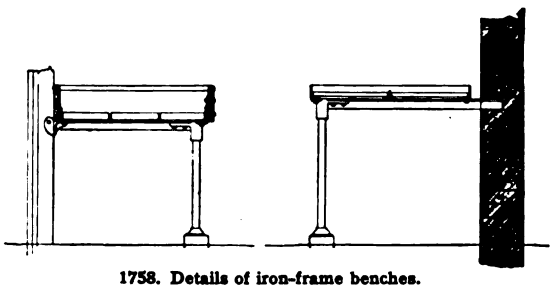
1757. Ridge-and-furrow houses.

A favorite size is 16 by 24 inches. This is about as large as it is practicable to use double thick glass, and makes a roof with comparatively few laps.

It is not safe to purchase fourth quality of glass or the so-called "greenhouse glass" frequently offered by window-glass dealers, as both of the grades contain the

culls and lights only fit to glaze cheap sash for market-gardeners, and is of doubtful economy even for this purpose. Rough plate and ribbed glass is used on large palm-gardens and conservatories in which the maximum of light is not an essential feature. Where this glass is used larger roof-bars are needed and stock construction has to be materially changed. Recently a few conservatories have been glazed with thick, polished plate-glass, making very handsome roofs, but rather expensive.

To set glass properly in a greenhouse roof, it should be bedded in the best putty on wood sash-bars and lapped at the joints. The bars should be spaced accurately, so that the glass will fit the rabbets with not over $\frac{1}{16}$ of an inch allowance, and the panes of glass should lap each other not more than from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch. Zinc shoe-nails fasten the glass best, using from four to six to each pane, according to the size of the light. No putty should be used on the outside of the glass. A comparatively new system of glazing has been adopted by some florists in which no putty is used, but the glass is placed directly on the rabbets of the bars and the ends of the panes are butted together and held in place by wood caps fastened to the sash-bars. This system does not make a tight roof, allowing considerable water to enter the house through the joints, nor does it provide any means of escape for the condensed water from the under side of the glass, which is a very serious objection. In ordinary glazing, where each light laps over the one below, the condensed water



1758. Details of iron-frame benches.

passes through the joints to the outside, forming a perfect remedy for this trouble. The difference in the cost is very slight, if anything, provided the work is equally well done, as the value of the putty omitted is fully offset by the extra cost of the caps.

The painting of a greenhouse roof is a very important part of the work. Owing to the extremes of heat, cold, dryness and moisture to which it is exposed, the conditions are decidedly different from ordinary buildings. Three-coat work is the best. The priming coat on the woodwork should be mostly oil, and, as far as possible, the material should be dipped into a tank of paint. Iron and steel framing material should be primed with a metallic paint. The priming coat should be applied before the material is exposed to the weather. The material of the second and finishing coat should be pure linseed oil and white lead. Experience has shown that this material is the best for this work. The color should be white or a light tint of any desired shade may be used, but no heavy color should be adopted which requires coloring matter in place of the lead in the mixing. Each coat should be applied thin and well rubbed out. While the appearance may not be quite so fine when the work is first done, the paint will not peel off, and will last longer and form a better protection for the structure than when it is put on in thick coats. It will also form a good base for repainting, and this should be done in a similar manner. It is economical to repaint a greenhouse every two years, and generally one coat will be sufficient. Neglected unpainted greenhouses soon suffer, and are also very unattractive.

Plant-tables.

Stages for plants in pots, or raised beds for planting out, usually cover the entire area of a greenhouse except the walks, and their cost constitutes a considerable proportion of the expense. Palms are usually grown in solid beds or in pots or boxes sitting on the ground. Many vegetables are grown in solid beds near the ground-level. Roses and carnations are usually in raised beds. Angle-iron frames supported on adjustable gas-pipe legs, with slate or tile bottoms, form the best plant-tables (Fig. 1758). Wood bottoms which can be readily renewed are frequently substituted, saving a part of the first cost. When the table supports are of wood, care should be taken that they are not fastened against any part of the framework of the house, unless iron brackets are used so as entirely to separate the woodwork.

Ventilation.

No greenhouse is complete without a good ventilating apparatus. About one-tenth of the roof should be arranged to open or close for ventilation, although this percentage will vary according to the form of house and the purpose for which it is used. It is not desirable to open all the ventilators in a long house with one set of apparatus, for frequently one end will not need so much ventilation as the other end or may be affected by the wind, forming a current lengthwise of the house. To avoid this, a greenhouse 200 feet long should have three or four sets of apparatus which can be operated separately. In all greenhouses of considerable width it is desirable that ventilation should be provided on both sides of the ridge so that the ventilation can be given on the "leeward" side, which will prevent the wind from blowing directly into the house.

Heating.

The success of the florist, gardener or amateur in the management of a greenhouse depends largely on the satisfactory working of the heating apparatus. There are two systems of greenhouse heating which, when the apparatus is properly installed, are economical and satisfactory; viz., hot water and steam. The open-tank hot-water heating has more advantage in its adaptation to general use than any other, and is so simple that its management is readily understood by anyone. It is practically automatic and is capable of maintaining an even temperature for ten hours without attention. Low pressure steam-heating is well adapted to large commercial ranges, and to large conservatories in parks and private places where a night attendant can be kept in charge of the fires to turn on and shut off steam from the radiating pipes as the changing outside temperature may require. The heating of greenhouses to the best advantage, under the varying conditions of climate and interior requirements, demands, like the designing of greenhouses, the services of an experienced specialist in horticultural work.

LORD & BURNHAM CO.

Vegetable forcing-houses.

The evolution of the vegetable forcing-house has been rapid and very pronounced. From the low-built, flue-heated, dark stuffy type of house to the high, well-lighted, steam- or hot-water-heated, well-ventilated house is a change that has come not only in a very short time but which has been as marked as the transition from the ox-cart to the automobile.

Location.

In selecting a suitable location for vegetable forcing-houses, one of the most important things to consider is the marketing possibilities. It would be folly to go to the expense of building a forcing-house in which to grow vegetables to make money if they could not be

sold at a profit above cost of production. The most desirable markets are those within easy driving distances. If it is necessary to ship the produce to be grown, electric lines will usually be found more economical carriers than steam lines. A grower is nearly always at a disadvantage if he has but one available road to ship over. Competition insures cheaper and better service. Cities with 25,000 to 50,000 population are often more desirable markets than much larger cities. Cities which are the chief shipping-points for southern-grown vegetables are not so good markets for forcing-house products as are the cities which are not so accessible from the localities making a business of growing winter vegetables for northern markets.

Another matter of importance to consider in choosing a forcing-house site is the cost of fuel. If natural gas can be secured at a reasonable cost it is a very satisfactory fuel. Coal is used most commonly as a fuel. When calculating the cost of coal, the hauling of it from the nearest shipping-point to the forcing-house should be included. It is expensive to move large quantities of coal a long distance, especially if the road is not good. When a dirt road must be used, it is usually best to do the hauling in late summer rather than in winter.

While any productive soil can be made suitable for forcing purposes, it is easier and cheaper to prepare a sandy soil than a heavy clay soil. Other things being equal, therefore, a location where the soil is a sand or sandy loam is to be preferred to a clay soil.

As large quantities of water are used in the forcing-house, an abundant supply should be known to exist before a site is selected for the houses. It is cheaper to build and easier to operate a forcing-house on level than on sloping land. A level site should, therefore, be selected if possible.

It is also an advantage to have the houses protected on the sides from which the prevailing winds come. Trees, hills or buildings are suitable for this purpose, providing they are not near enough to shade the houses much of the time. The site should not be far from the dwelling, and the closer it is to the market or shipping-point the better. A location which cannot be satisfactorily drained or which is subject to overflow should of course be avoided.

Types of forcing-houses.

Of the various types of forcing-houses, even-span, three-quarter-span, hillside and lean-to, only two are being built very generally at present. Many New England growers prefer the three-quarter-span, while the even-span is most popular in all other sections of the country in which forcing-houses are commonly erected. The three-quarter-span is used on sloping land as much as the hillside type of house, or even more. Good results are secured with either form.

Form of construction.

All-wood houses.—In the all-wood form of construction no iron is used except in the heating-plant. The walls may be all wood, or wood and concrete. The posts may or may not be set in concrete. The all-wood house was by far the most common form of construction only a few years ago and certain growers in various parts of the country still prefer the all-wood houses. Red cedar and cypress are the kinds of wood commonly used for forcing-house erection.

Semi-iron houses.—In the semi-iron form of construction all supporting posts, purlins and braces are made of iron pipes or angle-iron. The walls are usually made of concrete and all interior posts are set in concrete. The semi-iron houses are more expensive to erect than the all-wood houses but they are more durable and most growers think they are cheaper in the end.

All-iron houses.—In the all-iron construction the entire framework is of iron. The various parts are put together in such a way that the houses are very rigid. This form of construction is the most durable of all and will stand a greater weight of snow and more severe winds than the semi-iron or all-wood houses. The first cost of the all-iron houses is from one-third to one-half greater than the semi-iron construction, and this fact alone stands in the way of the general use of this construction. In spite of this objection, a number of large all-iron houses have been erected recently and they seem to be increasing in popularity, especially in the eastern part of the United States.

Trussed houses.—In the trussed form of construction, steel truss-rods are used to take the place of a part or all of the iron or wooden posts and braces used in the other forms of construction. The trussed houses are very convenient to work in and very little shade is cast by the framework. The truss-rods are frequently made to support the heating-pipes. They are also convenient supports for the wires upon which the cucumber and tomato vines are supported. As built in the past, trussed houses have not been strong enough, in all cases, to resist the weight of heavy snows and the force of severe winds. Several such houses have been demolished. If this defect can be eliminated this type of house will be very desirable.

Special features of forcing-house construction.

Width of houses.—The width of the forcing-houses in general use varies from 12 to 150 feet. In the East the tendency is to build houses 40 to 50 feet or more in width. In most parts of the West, the preference is for houses from 12 to 40 feet wide. However, there are individual growers in most sections of the West who prefer houses over 40 feet wide. The narrower houses are cheaper to build and can be kept in repair more cheaply and easily than wide houses. The wider houses, it is thought, can be heated more economically and are better adapated to the growing of warm plants such as cucumbers and tomatoes in winter than the narrower houses.

Length of houses.—The length of forcing-houses varies from 50 to 800 feet. When the gravity system of hot-water heating is used the houses are seldom over 200 feet in length. When either steam or hot water with artificial means of circulating is used, the houses may be of any length up to 1,000 feet. In most forcing centers the length of the houses has not exceeded 500 feet.

Direction of houses.—Lean-to and hillside houses are usually built with a southern exposure. Three-quarter-span houses are generally built to run east and west with the long span to the south. Even-span houses are built to run north and south, east and west and in some cases northeast and southwest. While there is not much difference in the results secured in even-span houses run either direction, there is a better distribution of sunlight throughout the day in houses which are run north and south.

Height of gutter.—Low gutters are almost entirely a thing of the past. Modern houses are usually built with gutters at least 6 feet high and 7-feet gutters are not uncommon. The outside walls of modern houses are very largely of glass construction. Connected houses are commonly built with no dividing partition except in case of extreme width when an occasional glass partition is put in. Some of the advantages of the high gutters combined with glass in the side walls and few or no dividing partitions are: greater convenience in working, better circulation of air and less shading. The former belief that the glass must be close to the plants, for best results has been found to be erroneous.

Pitch of roof.—The roofs of most even-span forcing-houses are built with a pitch of 30° to 35°. Three-quarter-span houses are usually built with the short span of the roof steeper than the long span. Hillside and lean-to houses are sometimes built with considerable less than a 30° pitch to the roof.

Glass and glazing.—Nothing but "A" quality glass is used in modern forcing-houses. Single-strength has been almost entirely replaced by double-strength glass. The standard size is 16- by 24-inch glass. It is usually laid the narrow way, although in sections of the country in which the snowfall is light the glass is frequently laid the 24-inch way. Twenty- by 24-inch glass is used by some growers. Butted glass was popular for a time and is yet with some growers, but lapped glass is most commonly used at the present time. When lapped, the glass is imbedded in putty and secured in place by the use of glazing-points. Butted glass is held in place by grooved strips of wood placed over the edges and fastened to the sash-bars with screws.

Ventilation.—An abundance of ventilation should always be provided, as the health of the plants is governed to a considerable extent by the ventilation given or not given at the proper time. When the narrow ridge-and-furrow type of forcing-house is used, provision is made for ventilators on only one side of the roof. If the houses are 30 or more feet in width, ventilators are usually placed on both sides of the ridge. In some cases, the ventilators are continuous, but owing to the liability of binding when so built most growers use separate ventilator sash. The sash are separated from each other by one or two lines of fixed glass. They are hinged on the ridge or on the header at the lower edge of the sash. When they are hinged on the header and open at the ridge the ventilation is more free, but cold draughts of air and rain or snow are more liable to enter than when the sash are hinged at the ridge and open at the lower edge. Side ventilators are a decided advantage in warm weather. When they are not provided, the air in the houses often becomes stale and oppressive. In such a condition it is unsuitable for normal plant-growth and unpleasant for those who are obliged to inhale it. Easy-working ventilator machinery should be provided for the ventilators both on the sides and roofs.

Heating.—For small forcing-houses, hot water is undoubtedly the most satisfactory method of heating. Some of the advantages of hot water over steam heat are: No night fireman is needed in small forcing-houses as the fire can be left for several hours without attention. Less fuel is required, especially in mild weather. The proper amount of moisture in the air can be maintained more easily. The heating-pipes if kept filled with water will outlast steam-heated pipes. The chief advantage of the steam heat over hot water is that it is cheaper to install. The reason for this is that when gravity is the means of circulating the water, larger pipes are required for properly heating the houses with water than are necessary where steam is the heat used. The gravity system is the principal method used in small hot-water-heated houses. Another advantage of steam over hot water is that the heat can be regulated more easily. When steam sterilization is practised it is an advantage to be able to use the same boilers for this purpose as are used for heating the houses. While a larger part of the large ranges of houses are heated with steam, some of the largest are heated with hot water. A ten-acre range of houses near Toledo, Ohio, is heated with hot water which is pumped through 1¼-inch heating-pipes. The houses are 700 feet long and cover a width of over 600 feet. There is but one heating-plant and it is located at the center of one side of the range. The heating-pipes are close to the ground and are nearly level from one end of the houses to the other. The water is pumped through the entire length of pipes in a very few minutes. The installation of this hot-water heating-plant cost little if any more than a steam heating-plant would have cost and it can be operated more cheaply than a steam plant which would be large enough to heat a range of houses of the same size.

Heating-pipes.—Practically all pipes used for heating purposes at the present time are of wrought-iron. They are threaded and can be united by screwing them into connections made for the purpose. This method of connecting furnishes a tight joint and can be easily put together. Two-inch pipes are used as a rule for hot-water heating with gravity means of circulating. For hot water with forced circulation and for steam, 1¼-inch pipes are generally considered the best size to use.

Benches vs. beds.—In nearly all vegetable-forcing centers, except Chicago, raised benches are no longer used except by an occasional grower. The cost of building the benches is so great that most growers think the added cost more than offsets the advantages of the benches over the beds. Cement benches when arranged for sub-irrigation are very satisfactory. They are especially desirable for lettuce and tomatoes. Surface-watered benches are not nearly so satisfactory for these crops as sub-irrigated benches. Ground beds are frequently made with concrete sides but the more recent plan is to have nothing but narrow concrete walks to separate one bed from another.

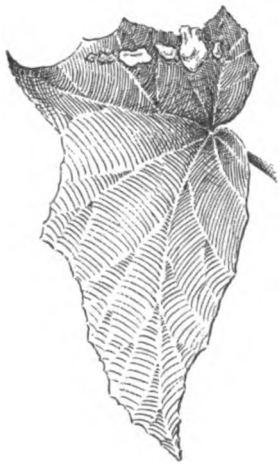
Service room.—One of the features which goes with an up-to-date vegetable-forcing plant is a conveniently arranged and well-lighted service room. Provision should be made for washing vegetables and for other operations which go with a proper preparation of the vegetables for the market.

Plant-house.—Another important adjunct to a modern forcing-house is a plant-house which is independent of the other part of the range so far as the heating of it is concerned. To grow young plants successfully, especially warm plants such as cucumbers and tomatoes, it is important to be able to provide the proper temperature for each kind of plant. This can be done to best advantage if the plants can be grown in a plant-house built especially for that purpose.

C. W. WAID.

Greenhouse glass.

The selection of glass for greenhouses, and the nature of the imperfections which render it undesirable for such use, are questions which have received much attention from horticultural writers, and which have brought forth a variety of answers. Three qualities are essential in all glass to be used in greenhouse construction: first, minimum of obstruction to solar rays; second, strength sufficient to withstand the strain of winds and storms, especially hail; and third, freedom from defects that render it liable to burn plants grown under it.



1759. Burned areas on a begonia leaf.

It is an established fact that plants thrive best under a clear and transparent glass, which lets through the greatest possible percentage of the sun's rays. This includes all the solar rays, calorific or heat rays, and actinic or chemical rays, as well as the colorific or light rays. Clear white glass of the grade known as "single thick" (twelve panes to the inch) lets through from 60 to 70 per cent of the sun's rays; common green glass of the same thickness, 52 to 56 per cent, and "double thick" (eight panes to the inch) common green glass, from 50 to 52 per cent. This percentage is reduced by

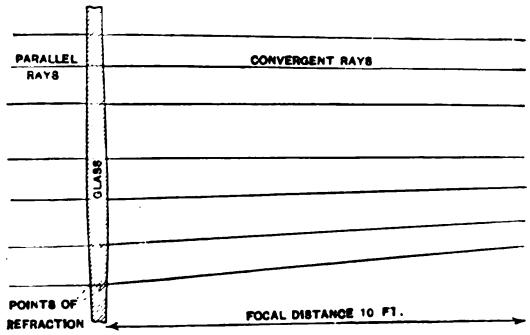
other colors, dark blue glass letting through but 18 per cent. In connection with the matter of tint, it should be noted that some glass, especially clear white glass purified with arsenic acid, or that in which a large amount of potash is used in proportion to the amount of lime employed in manufacture, becomes dull after long exposure to the weather, the dullness being occasioned by the efflorescence of salts contained in the glass. Before this disintegration has proceeded too far, the crust or efflorescence may be removed with muriatic acid.

The strength of glass depends upon its thickness and upon the thoroughness of the annealing. Glass is annealed by passing through a series of ovens, where it is raised to a high heat and then gradually cooled; whatever toughness and elasticity the finished product may contain is due to this process. The thickness of glass varies, not only with grades (single and double thick), but also more or less within the grades, and even in different parts of the same pane. Single thick glass is too thin for use in greenhouses; in selecting any glass for such a purpose it should be examined pane by pane, and all showing marked variation in thickness, either between panes or in different parts of the pane, rejected. A pane of varying thickness is much more liable to breakage from climatic changes or sudden shocks than one which is uniform in this regard. From the foregoing statements it will be seen that, in general, the ordinary double-thick green glass is best as regards both tint and strength, green glass being less liable to change in tint than white, and the double-thick being the stronger grade. By green glass is meant simply the ordinary sheet glass, the green color of which is noticeable only at the cut edge.

It has long been a common opinion that such visible defects in sheet glass as the so-called "bubbles," "blisters," and "stones," produce a focusing of the solar rays passing through them, thus burning the foliage of plants grown under glass containing these defects (Fig. 1759). This view has been held by glass manufacturers and horticulturists alike, and seems not to have been contradicted publicly until 1895 (Bulletin No. 95, Cornell University Agricultural Experiment Station, page 278). In view of the erroneousness of this theory, it is rather remarkable that it should have gained such prevalence. Nearly all bubbles and blisters are thinner in the middle than at the periphery, being thus concave rather than convex lenses, and actually diffusing the rays of light passing through them rather than producing destructive foci. While it is true that sand-stones or knots in glass may produce foci, these points of focus scarcely ever exist more than a few inches from the surface of the glass; consequently, these defects can do no damage when occurring in roofs several feet distant from the growing plants below.

The only full and complete series of experiments on this subject in this country (conducted at the Cornell University Agricultural Experiment Station, the Physical Laboratory of Cornell University, and a glass factory in Ithaca, New York, but yet unpublished) shows the true cause of the burning by glass to be the variation in thickness of the entire pane, or a portion of it, thus producing a prismatic or lens-like effect (Fig. 1760), which causes a more or less distinct focusing of the sun's rays at distances varying from 5 or 6 feet to 30 feet, or even more, from the glass.

This defect usually occurs along the side or end of the pane and is not visible to the eye, but it may be detected easily by using the micrometer caliper or by testing in the sunlight. It may be found in all kinds of glass, and is caused by the glass-blower while reducing the upper or pipe end of the cylinder from which sheet glass is made, thus facilitating the removal of the "cap" or neck end of the cylinder, by which it is attached to the pipe while being blown. The defect, as already stated, is one which may be found in all grades and qualities of sheet glass, of both foreign and domestic manufacture. The fact is well known that differences in the thickness of spectacle lenses, which are imperceptible to the eye, may produce sufficient refraction to vary materially the direction of rays of light passing through such lenses, and it is not difficult to see that the same effect may be produced by similarly imperceptible variations in the thickness of sheet glass. That this is the case has been conclusively shown by the series of experiments mentioned above. These also



1760. Refraction of light rays by an irregular pane of glass.

show that burns on plants caused by defective glass roofs occur in lines and not in isolated spots, burns of the latter description being usually the result of a weakening or deterioration of tissue, due to carelessness in the matter of ventilation, humidity of the atmosphere, water, and temperature of greenhouses, rather than to defects in the glass.

If, therefore, it is not possible to secure glass of uniform thickness with certainty, it may be found cheaper and often fully as satisfactory to purchase the lower or common grades of double-thick glass, using in the roof only those panes which show, after testing in the sunlight for foci, an entire lack of the prismatic character which makes them dangerous to plants grown under them.

J. C. BLAIR.

Greenhouse heating.

In all sections in which the temperature drops below the freezing point, it is necessary to provide some artificial means for heating greenhouses. Nearly all modern structures are warmed either by steam or hot water, although hot-air flues are occasionally used. While hot water is preferred for small ranges of glass, as it can be depended upon to furnish an even degree of heat when left for a number of hours, steam is very generally used for extensive plants, as the cost of piping the houses is much less than when hot water is used. Steam boilers require more attention than hot-water heaters, but when there is more than 10,000 or 12,000 square feet of glass, it is best to have a night fireman and watchman, and the extra expense can be made up by the saving in the cost of fuel, as it will be possible to use a lower grade of coal. Under these conditions the cost of running a steam plant will be as low as with hot water, but in small houses, where hard coal is used, and the fires receive no attention for six to eight hours during the night, hot-water heaters will be cheapest to operate, and will be most satisfactory. Some of the up-to-date ranges of the largest size make use of hot water and are able to secure a perfect circulation by the use of steam or electric pumps, which also make it possible to reduce the size of the piping, and as a higher temperature is maintained in the water, the amount of radiation required and consequently the cost of piping the houses is reduced practically to that in steam systems. Similar results can be secured in closed sys-

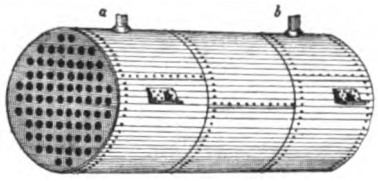
tems where some method of placing the water under pressure is used. See, also, under *Forcing-houses*, p. 1402.

As the various flowers and vegetables grown under glass require different temperatures, the piping of greenhouses has to be varied accordingly. Thus, although it may vary from 3° to 5° for different varieties of the same species, our common plants require the following night temperatures: violets and lettuce, 45° to 55°; radishes and carnations, 50° to 55°; roses and tomatoes, 60° to 63°; cucumbers and stove plants, 70°.

Boilers.

For small ranges, whether steam or hot water is used for heating, the best boilers are those constructed of cast-iron as they will be found more durable than those in which wrought-iron or steel is used. By using either vertical or horizontal sections, it is possible to build up boilers of considerable size, but, especially if to be used for steam heating, it will be preferable to use wrought-iron or steel boilers if they have a capacity of more than 2,000 square feet of radiation. Except for those of extremely large size, the ordinary tubular boilers will be found adapted both for steam and hot-water heating, although when used for hot water they will be more effectual if the entire shell is filled with tubes, as there is no occasion for leaving a steam space at the top of the boiler. Such boilers are of low cost, economical and durable.

There are also on the market several forms of wrought tubular boilers which are giving good results for heating greenhouses with hot water. For ranges of the largest size, where forced draft is used, water-tube boilers are extremely powerful and very satisfactory. When installing a heating-plant, it will be safest to use two or more boilers rather than one large one of the same capacity, as when there is only a single boiler serious losses may result if repairs to the boiler become necessary in extremely cold weather, which might be lessened or entirely prevented when there are two or more boilers in the battery, and it is possible to cut out the one which has become damaged. Especially in mild weather during the spring and fall, the firing will be more economical when it is possible to use a boiler just large enough to heat the houses, rather than one which is several times larger than is necessary at that time, as would be the case when only one boiler is used.



1761. Horizontal tubular boiler for hot water.

The durability of the boiler and the economy of heating will be greatly increased when the heating capacity is considerably larger than is really necessary, as when the firing is forced in extremely cold weather it will not only result in a loss both in fuel and labor, but will shorten the life of the boiler.

The size of hot-water boilers is usually expressed in terms of radiation, or the number of square feet of heating surface it can supply economically. In a given boiler there is a fixed ratio between the size of the grate and the area of the fire surface of the boiler, but this will depend very largely upon its construction and efficiency of the fire surface, as well as upon the size of the boiler. In the case of small hot-water boilers the ratio between the grate and fire surface is often as small as 1 to 15, while it may be as much as 1 to 35 in larger ones, and even more when the boilers have frequent attention and hard coal is used. One reason for using a relatively large grate in small boilers is because it makes it possible to leave the fire for eight or ten hours without care or attention, while for large boilers and where a night fireman is employed, the ratio between the grate and fire surface may be much greater.

The capacity of steam boilers is usually rated in horse-power, and it is considered that for each horse-power a boiler will heat 100 square feet of radiation; an average of 15 square feet of fire surface is considered equal to one horse-power, it being customary to estimate that 10 or 12 feet in a large boiler will equal one horse-power, while in a very small one as much as 18 feet would be required. Thus, in medium-sized boilers an area of 10 square feet of grate will answer for 250 square feet of fire surface and this will be sufficient for about 1,700 square feet of radiating surface when steam is used; and as 75 to 100 per cent more radiation will be required when hot water is used, a boiler of the above size will answer for 2,800 to 3,400 square feet of hot-water radiation. In the case of small boilers that will not have attention at night, it is usually advisable to reduce the above estimates about 25 per cent, and when a boiler is required for 1,000 square feet of radiation, we should select one that is rated at 1,250 square feet.

Home-made coil boilers are sometimes constructed for hot-water heating since the cost will generally be considerably less than for tubular boilers. As a rule, however, they will be found less durable and lacking in efficiency as compared with the better class of greenhouse boilers now on the market. For making such boilers, 2-inch wrought-iron pipe in lengths of 4 to 6 feet is used. Formerly 1-inch pipe was used for coil boilers but it is comparatively thin, and, especially where the threads were exposed it was quickly eaten through so that it proved far from being as durable as the larger sizes of pipe. There was also more trouble from the boiling over of the water than when larger pipes were used and if the boilers are constructed of 1-inch pipe it is necessary either to have an elevated expansion tank or run it as a closed system. In making a coil boiler, the pipes are cut of the desired length and the ends are connected either by return bends or by manifolds so as to form a number of vertical coils, each containing from six to ten pipes. The upper ends of the manifolds are joined at the front end of the heater and connected with the main flow-pipe; while the lower ends of the rear manifolds are joined to the returns. As a rule, the grate is of the same width as the coils and from one-half to two-thirds as long.

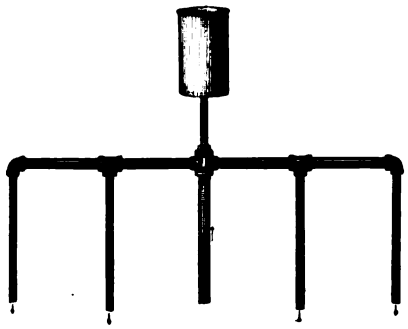
Although a box coil is much cheaper than a cast-iron heater, when we have added the cost of the grate, doors and other fittings, and of bricking it in, the amount saved will not be large, and its use will often be found less economical, especially as the coil boilers are, as a rule, not more than one-half as lasting as cast-iron boilers, most of which are complete in themselves and require no brickwork or trimmings.

Hot-water piping.

When hot water first came into use for the heating of greenhouses, 4-inch cast-iron pipes were used, but, as the joints were packed with oakum, cement or iron filings, they frequently gave trouble by leaking and it was much more difficult to make changes or repairs than in the present systems for which small, wrought-iron pipes with screw joints are used. Owing to the large amount of water in the cast-iron pipes, the circulation was necessarily quite sluggish and it was not easy to secure the high temperature in the water that can be obtained with smaller pipes. Another objection to the use of these large pipes is that it is not possible to carry the flows overhead, while with smaller pipes one may not only have the flows but some or all of the return-pipes above the level of the benches. By elevating the pipes above the level of the boiler, the rapidity of the circulation and the temperature of the water in the pipes can be considerably increased.

In case a number of houses are to be supplied from

one boiler, or if the heater is at some distance from the coils, it is better to start from the boiler with one large flow-pipe, or with two pipes leading from different sides of the boiler, rather than carry an independent pipe to each house. When there are several houses to be heated, it is customary to have them side by side and one large flow-pipe can then be run across the nearest end of the houses from the boiler. If the houses run north and south, the boiler may be located at one corner or in the middle of the north end of the range, and either a work- or storeroom, or some other form of a head house, should be constructed in which the



1762. Supply-pipe for under-bench flows.

main heating-pipes can be carried, as well as to protect the north end of the houses and facilitate getting from one to another. Sometimes greenhouses run east and west, in which case there should either be a head house at the east end of the range, or if the houses are more than 200 feet in length it may be run through the center of the houses.

The size of the main feed-pipe as well as of the branch pipes should be in proportion to the amount of radiation they supply. In determining the amount that can be handled by pipes of different sizes, it is always advisable to use somewhat larger supply-pipes when all of the radiation, both flow and return, are under the benches, than when all of the flow-pipes, at least, are overhead. A similar allowance should be made when the boiler is partly above the level of the returns, as compared with systems in which the coils are a number of feet above the top of the boiler, since in the latter case a much smaller supply-pipe will suffice. In a general way, the following sizes can be used as supply-pipes:

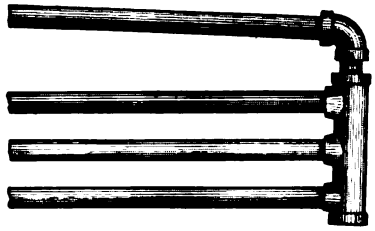
Size of pipe.	Square feet of radiation.
1½-inch.	75 to 100
2 -inch.	150 to 200
2½-inch.	250 to 350
3 -inch.	400 to 600
3½-inch.	600 to 800
4 -inch.	1,000 to 1,200
5 -inch.	1,500 to 2,000
6 -inch.	2,500 to 3,500

The main supply-pipe or pipes should, if possible, rise vertically from the heater to a point somewhat higher than the highest point in the system, and then as it runs out through the houses should be given a slight fall, say 1 inch in 20 feet, so that there will be no opportunity for the pocketing of air in the pipe. While a slight downward slope will unquestionably give better results than the uphill arrangement which is sometimes used, the difference will be comparatively slight and, if the circumstances make it preferable to run the flow-pipes uphill, satisfactory results will be obtained provided they are considerably elevated above the boiler. Especially, if the flow-pipes run uphill, it will be advisable to have them of good size.

When taking off the supply for each of the houses, one large pipe of a size sufficient to provide the amount needed may be used, or from two to five smaller pipes may lead from the main flow-pipe into each of the houses. For houses up to 250 feet in length, it will generally be found desirable to run 2½-inch flow-pipes through the house, but for longer houses 3-inch flow-pipes should be used. Just how many flow-pipes will be needed will depend not only upon the length of the house, but upon the number of return-pipes to be supplied. Thus, while a 2½-inch flow will supply two 2-inch returns in a house 250 feet long, the number of returns which it will feed in shorter houses will be nearly in inverse proportion to the length of the return coils. When the amount of radiation to be supplied does not exceed 250 to 350 square feet, one 2½-inch flow-pipe in a greenhouse will be sufficient and this should preferably be placed from 1 to 3 feet below the ridge. For slightly larger houses, two flow-pipes may be located on the wall plates. If as many as five pipes are necessary, the fourth and fifth pipe may be suspended from the roof under the middle of the sash-bars. In the case of houses so large that more than five 2½-inch flow-pipes are required, 3-inch flows should be used.

The length of the coils and their height above the boiler will determine the size of the pipe which should be used for the returns, since a smaller size will answer in short coils and in those that are considerably elevated than for long coils which are but little, if any, above the level of the boiler. For the construction of coils 75 feet or more in length, 2-inch pipe should be used, and it will generally be found preferable to a smaller-sized return-pipe when they are only 50 feet in length, especially if the flows are under the benches or when the coils are below the top of the boiler. For short coils, pipes as small as 1¼-inch may be used where they are somewhat elevated but for ordinary commercial greenhouses it will be better to use 2-inch pipe for the returns, although 1½-inch pipe might answer in houses up to 75 feet in length, as, while small pipe furnishes the most effective radiation to the square foot, the increased friction impedes the circulation.

In narrow houses, the return-pipes may be placed upon the side walls, but as the width increases it will be generally advisable to have from one-third to one-half of the returns either under the benches or in the walks when beds are used. From the fact that running the pipes overhead will not only improve the circulation but will prevent cold draughts of air upon the plants, it is often desirable when but one overhead flow-pipe is used to bring back one return upon each of the purlins. When the end of the house is much exposed, it is an excellent plan to drop down one feed-pipe from the end of the main, or two when there is a door in the end of the house, and supply coils running in either direction to the corner of the house and thence along the walls toward the end where the heater is located. Particularly when the pipes are but little, if any, above the top of the boiler, the circulation will be improved by carrying the return-pipes as high as possible, but of course care should be taken when they are under the benches not to have them so high that they will dry out the soil.



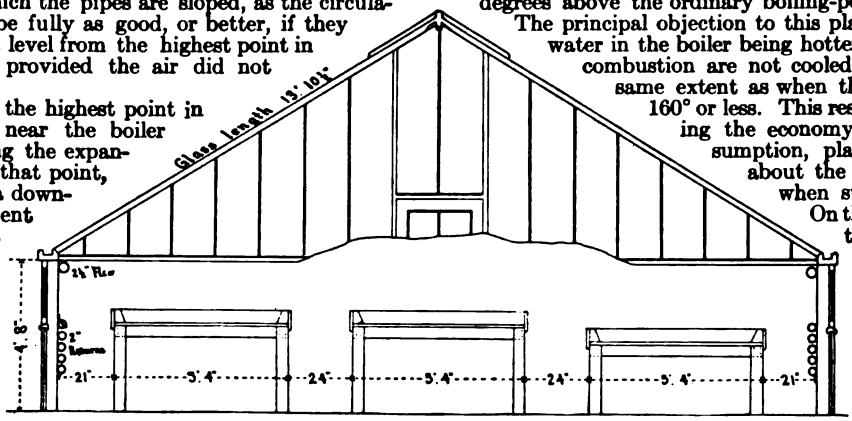
1763. Pipe work for modern greenhouse heating. A wall coil.

The returns may be arranged in horizontal coils under the benches, or in vertical coils on the walls, or on the sides and supports of the beds and benches. The pipes in the coils may be connected at their ends either by means of manifolds, or by tees and close nipples, but in either case provision should be made for

expansion of the pipe which with vertical wall coils may be done by running them partly across the ends of the houses and the same means may be used in horizontal coils, or the headers at the lower ends of the coils may be connected with the ends of the pipes by means of nipples and right and left ells. Whenever possible, there should be at least two returns supplied by each of the flow-pipes and the number may be increased until the capacity of the flow is reached. In determining just how many returns may be supplied by a given flow-pipe, one should always make allowance for the radiation furnished by the flow-pipe itself and, as the friction will be greater in a large number of short returns than for the same radiation with long returns, this should be considered in adjusting the ratio between the flow- and return-pipes.

Even greater attention should be given to the grading of the small return-pipes than to the larger flow-pipes, as the danger from pocketing of the air will be increased. For the smaller sizes, it will be advisable to give them a slope of at least 1 inch in 15 feet; but, if carefully graded and securely supported at intervals of 10 feet, good results can be obtained with 2-inch pipe with a fall of 1 inch in 20 feet; and if no more than 1 inch in 30 feet is available even this light fall will generally suffice to rid the pipes of air. This is really the main object for which the pipes are sloped, as the circulation would be fully as good, or better, if they are run on a level from the highest point in the system, provided the air did not pocket.

By having the highest point in the system near the boiler and attaching the expansion-tank at that point, one secures a downhill arrangement of the pipes which not only gives a better circulation than when the flow-pipes run uphill, but it does away entirely with air-valves which must be provided when the flow-pipe runs uphill and which often give trouble.



1764. Carnation-house, 100 x 23 ft. 6 in., piped for hot water.

The method of piping which has been advocated, i.e. running one or more pipes in each house to the farther end and there connecting them with the returns, will give a more even temperature than can be secured in any other way. Formerly, it was the custom to connect the supply-pipes with the coils at the end of the house nearest the boiler. In some cases, one-half of the pipes in the coils served as flows to feed an equal number of return-pipes, or all of the pipes in the coil were connected at the farther end of the house with a main return-pipe, of the same size as the feed-pipe, which was brought back underneath the coil, or all of the coils in the house were connected into one main return. When the latter arrangement is used, the heating of the house is less uniform than with an overhead flow-pipe, the farther end of the house being cooler than the one near the heater.

Unless the heating system is connected directly with the water-supply system, which is used as an expansion-tank, a special tank must be provided and connected with the highest part of the flow-pipe or with one of the returns near the heater. While it would answer if this tank is located at some point but slightly above the heating system, it is always desirable to have it somewhat elevated, as this will raise the boiling-point of the water in the system and hence increase its efficiency, as well as lessening the danger of its boiling over. The pipe connecting the expansion-tank with the heating-pipes should not be less than ¾ inch and this should be increased to 1½ to 2 inches in large systems. The size of the expansion-tank should be sufficient to equal the amount which the water in the system will increase in volume when it is raised from a temperature of 40° to 200°, with a margin of perhaps 50 per cent. By connecting the expansion-tank with the highest part of the system, one not only does away with the necessity of using air-valves but also lessens the tendency of the water to boil over.

When there are several houses in the range connected with one system, it is always a good practice to have a valve upon the supply-pipe leading to each house, with other valves upon at least one-half of the coils. It will thus be possible to reduce the radiation in each house or to cut it out entirely if desired.

Hot water under pressure.

Especially in large ranges it is now becoming customary to place the water under pressure, thus making it possible to raise the temperature at which it will boil, and in this way the circulation can be improved, and instead of the water in the returns having an average temperature of 150°, it can be maintained several degrees above the ordinary boiling-point of water. The principal objection to this plan is that the water in the boiler being hotter, the gases of combustion are not cooled down to the same extent as when the water is at 160° or less. This results in lessening the economy of coal-consumption, placing it upon about the same plane as when steam is used. On the other hand, this system has the merit of reducing the amount of radiation required in the heating-system, and in this way lessening the cost of piping the greenhouse fully twenty-five per cent.

Various methods of placing the water in the heating-system under pressure have been employed. Among them is to use a safety-valve and a vacuum-valve, either upon the expansion-tank, or if this is not closed, upon the expansion-pipe within the tank. The safety-valve allows either the air or the water, as the case may be, to pass out of the system when the pressure desired is reached, while the vacuum-valve permits the air or water to re-enter the system when the pressure drops.

What is known as the "mercury generator" or "circulator" also serves the same purpose. In these a column of mercury prevents the escape of the water in the system until the pressure has reached the point desired, when it allows a portion of the water to escape and, later on, to re-enter the system when the pressure decreases. It will be seen that this acts in exactly the same way as the safety-valve and vacuum-valve described above. By raising the boiling-point of water and improving the circulation, it not only makes it possible to use smaller pipes both for flows and returns, but the amount of radiation required will be considerably reduced. In fact, although it is not advisable to carry it to that extent, it is possible to reduce the amount of radiation practically to that required for steam-heating.

This system is of value particularly in sections of the country in which the usual winter temperature is well

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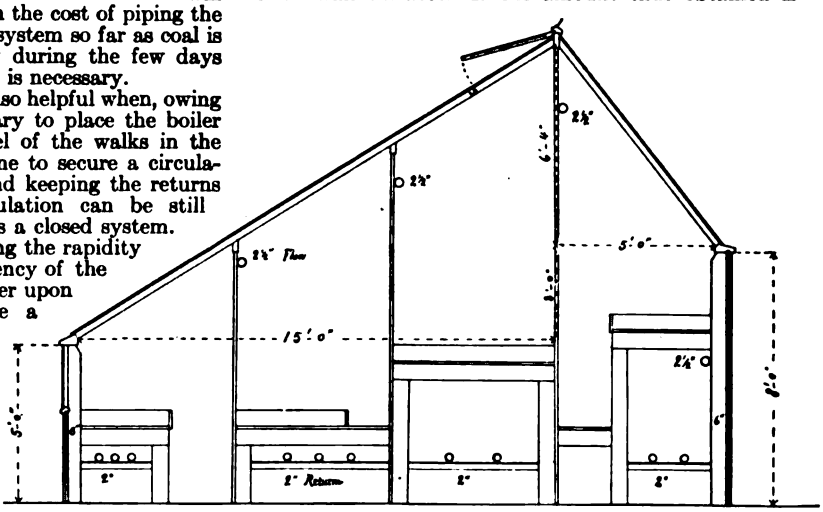
above zero but where the mercury drops 10° to 15° for a short period each winter. By piping the houses so that the desired temperature can be obtained for the houses in ordinary weather by using an open system, it will then be possible by using a "circulator" to maintain the same temperature in the houses even though the mercury drops 15° or 20° lower. This will make a considerable difference in the cost of piping the houses and the efficiency of the system so far as coal is concerned will be affected only during the few days when the use of the "circulator" is necessary.

The use of a closed system is also helpful when, owing to local conditions, it is necessary to place the boiler upon or slightly below the level of the walks in the houses. While much can be done to secure a circulation by using overhead flows and keeping the returns as high as possible, the circulation can be still further improved if it is run as a closed system. Still another method of increasing the rapidity of the circulation and the efficiency of the heating-system is to place either upon the main flow- or return-pipe a pump, worked by steam or electricity, by which it will be possible greatly to accelerate the circulation of the water, so that such matters as the relative elevation of the boiler and heating-pipes will need but little consideration and it will be possible to decrease to a considerable extent the size and number of the heating-pipes.



1765. Rose-house, 150 x 20 ft., piped for water.

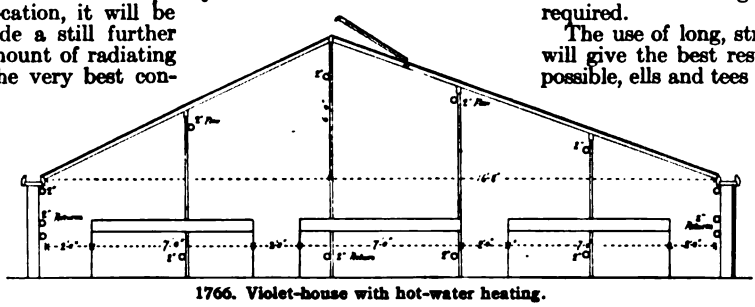
Estimating hot-water radiation.

Owing to the great variations in temperature and the differences in the construction of greenhouses, and also in their exposures, it is impossible to give any explicit rules regarding the amount of radiation that will be required under all conditions; but experience has shown that in well-built houses any desired temperature can be secured. Knowing the minimum outside temperature and the temperature to be maintained within the house, it is necessary only to install a heating-plant with a radiating surface having a certain definite ratio to the amount of exposed glass and wall surface. It is, of course, understood that there must be a proper adjustment between the size of the boiler and the radiating surface and that the system is so arranged as to give good results. Thus, when a temperature of 40° is desired in sections in which the mercury does not drop below zero, it will be possible to maintain it when 1 square foot of radiating surface is provided for each 5 square feet of glass; if 45° is required there should be 1 foot of radiation for 4½ feet of glass. Under the same conditions, 50°, 55°, 60°, 65° and 70° can be obtained, respectively, by using 1 square foot of radiating surface for each 4, 3½, 3, 2½, and 2 square feet of glass. When the outside temperatures are slightly under or above zero, there should be a proportionate increase or decrease in the amount of pipe used; and, if the houses are poorly constructed or in an exposed location, it will be desirable to provide a still further increase in the amount of radiating surface. Under the very best conditions, the temperatures mentioned can be obtained with a slightly smaller amount of radiation, but the greatest economy so far as coal-consumption and labor are concerned will be secured when the amount of radiation recommended is used.

In determining the amount of exposed glass surface, the number of square feet in the roofs, ends and sides of the houses should be added, and to this it will be well to add one-fifth of the exposed wooden, concrete or brick wall surfaces. If the amount thus obtained is divided by the number which expresses the ratio between the area of glass and the amount of radiation which will be required, it will give the number of square feet of heating-pipe which must be installed. The unit of measurement of wrought pipe is its interior diameter, while its radiating surface is determined by its outside circumference, and, although it will vary slightly according to the thickness of the pipe, it is customary to estimate that 1-inch pipe will afford about .344 square feet of radiating surface to the linear foot, while 1¼-, 1½-, 2-, 2½-, and 3-inch pipe will furnish respectively .434, .497, .621, .759 and .916 square feet of radiation for each foot in length of pipe. The following example will perhaps aid in determining the amount of radiating surface and its arrangement in a greenhouse. If a house is 32 feet in width and 200 feet in length, with 30 inches of glass in each side wall and with one end only of exposed glass, and a concrete wall 3 feet high on two sides and one end, there will be about 9,000 square feet of glass. To heat this to 50° in zero weather it will be necessary to use one-fourth as much radiating surface, or 2,250 square feet. In a house of this length it will be possible to supply this amount of radiation by means of five 2½-inch flow-pipes, and the remaining radiation will be provided by means of ten 2-inch returns which will allow two for each of the flow-pipes. These figures are intended to apply when an open system is used but, if a "generator" is attached, not to exceed four flows and eight returns will be required.

The use of long, straight runs of pipe will give the best results and, whenever possible, ells and tees should be avoided, but if they must be employed special hot-water fittings should be secured.

In conservatories with high side walls it is desirable to place the flow-pipes at the



1766. Violet-house with hot-water heating.

plate and the returns on the walls or under the tables. Figs. 1764–1766 illustrate the lay-out of pipes in carnation-, rose-, and violet-houses.

Heating by flues.

When fuel is cheap, and when either a low temperature is desired in the house, or the outside temperature does not drop much below the freezing point, hot-air flues may be used but, while the cost of constructing them is small, the danger of fire is so great that they are often found to be far from economical. A brick furnace is built at one end of the house and from this a 10- or 12-inch flue is constructed to carry the smoke and hot gases through the house to the chimney which may be either at the farther end of the house or directly over the furnace, the flue, in the latter case, making a complete circuit of the house. When the houses to be heated are more than 60 feet long, it is advisable to have a furnace in each end, with the flue from each extending only to the center of the house and returning to the end from which it started. For the first 30 feet the lining of the flue, at least, should be of fire-brick, but beyond that the flue may be constructed of sewer-pipe.

Piping for steam.

Except that it is possible to use smaller flow- and return-pipes, the arrangement of the piping for steam-heating is not very unlike that described for hot water. Unless the houses are more than 30 feet wide and 150 feet in length, only one flow-pipe need be used and that can be carried from 2 to 4 feet below the ridge. In wider and longer houses, it is generally advisable to put in two or more flows. One of these flows can be carried on each wall-plate and in extremely wide houses others may be under the ridge and purlins.

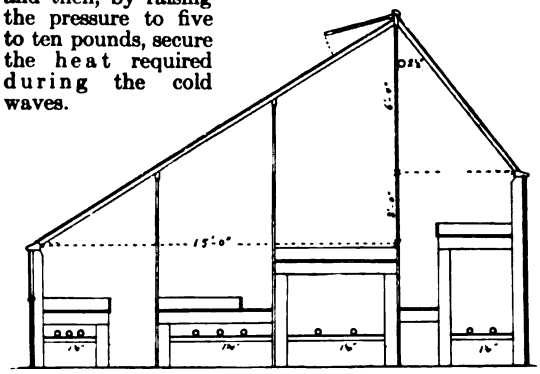
For determining the size of steam mains, a good rule to use is to take one-tenth the square root of the radiation to be supplied and consider this to be the diameter in inches of the main required. Thus for supplying 400 square feet of radiating surface we would take one-tenth the square root of 400 ($\sqrt{400} \div 10 = 2$), which will give 2 inches as the diameter of the main required. As the amount of radiation increases, a slight reduction can be made in the size of the mains and 2½-, 3-, 3½-, and 4-inch supply-pipes will answer respectively for 700, 1,000, 1,400 and 1,900 square feet of radiation. This is intended to apply with low-pressure steam, and as the steam-pressure is increased above five pounds a slight decrease in the size of the mains would be permissible.

The size of the pipes to be used for the coils will also depend upon the length of the house. For ordinary lengths 1¼-inch pipe will be desirable, but, when they are more than 250 feet in length, 1½-inch pipe may be used with low pressure steam and, in those much less than 100 feet, 1-inch pipe will answer. The location and arrangements of the coils will necessarily be determined by the openings in the walls and whether beds or raised benches are used. One of the simplest and most satisfactory ways of piping a greenhouse of moderate size, say from 20 to 30 feet in width and up to 150 feet in length, is to run the flow-pipe, which would be either 2- or 2½-inch, overhead and bring back the coils on the walls, or, if raised benches are used and crops for which bottom heat will be helpful are to be grown, from one-third to one-half of the return-pipes may be distributed under the benches and the remainder may be on the walls. The return-coils should of course be given a slight slope toward the boiler, care being taken that no opportunity is afforded for the air to pocket and prevent the free flow of the water from the condensed steam back toward the boiler. A fall of 1 inch in 10 feet will suffice, and even less will answer if care is taken in grading and supporting the pipes.

In order to prevent the water from backing up in the coils, it is desirable that they should be at least 18 or 20 inches above the level of the water in the boiler, while 3 or 4 feet would be even better and will be necessary in large ranges. Unless this can be secured it will not be possible to return the water of condensation to the boiler by gravity and either a steam trap or pump should be provided for the purpose. By means of these, the water can be carried to a water feed-tank from which it can be fed into the boilers.

There should be an automatic air-valve at the end of each coil and, in order to regulate the amount of steam, a shut-off valve should be placed upon both flow- and return-pipes leading to each house. Unless there are several coils in each house, one or more of which could be cut off by means of valves, it will always be well to have valves upon a number of the pipes in the coils so that all but one or two can be cut off if desired. To prevent the water from being forced out from the boiler when the steam is turned into the houses, there should be a check valve in the main return-pipe near the boiler.

The amount of radiation which will be required to secure a given temperature will vary to some extent with the amount of pressure carried in the boiler, or in the coils, when a reducing-valve is used, but as a rule, this is not much more than five pounds and often it is even less. It will be best to provide a sufficient amount of radiation to furnish the temperature desired in ordinary cold weather without carrying any pressure and then, by raising the pressure to five to ten pounds, secure the heat required during the cold waves.



1767. Rose-house, 150 x 20 feet, piped for steam.

In determining the amount of radiation for a steam-heated house, for zero weather, it will answer if one considers that 1 square foot of pipe will heat 9 square feet of glass when 40° are desired, and will suffice for 7, 5 and 3 where 50°, 60°, and 70°, respectively, are, required. Fig. 1767 illustrates the piping required for heating a rose-house with steam. L. R. Taft.

Greenhouse management.

Persons usually learn to grow plants under glass by rule of thumb. Such practical knowledge is always essential, but better and quicker results are secured if underlying truths or principles are learned at the same time. Even if no better results in plant-growing were to be attained, the learning of principles could never do harm, and it adds immensely to the intellectual satisfaction in the work. There is no American writing that essays to expound the principles of greenhouse management, although there are manuals giving direct advice for the growing of different classes of plants. There are two kinds of principles to apprehend in greenhouse management,—those relating to the management of the plants themselves, and those dealing primarily with the management of the house.

The first principle to be apprehended in the growing

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of plants under glass is this: *Each plant has its own season of bloom.* Every good gardener knows the times and seasons of his plants as he knows his alphabet, without knowing that he knows. Yet there are many failures because of lack of this knowledge, particularly among amateurs. The housewife is always asking how to make her wax-plant bloom, without knowing that it would bloom if she would let it alone in winter and let it grow in spring and summer. What we try to accomplish by means of fertilizers, forcing and other special practices may often be accomplished almost without effort if we know the natural season of the plant. Nearly all greenhouse plants are grown on this principle. We give them conditions as nearly normal to them as possible. We endeavor to accommodate our conditions to the plant, not our plant to the conditions. Some plants may be forced to bloom in abnormal seasons, as roses, carnations, lilies (see *Forcing*). But these forcing plants are few compared with the whole number of greenhouse species. The season of normal activity is the key to the whole problem of growing plants under glass; yet many a young man has served an apprenticeship, or has taken a course in an agricultural college, without learning this principle.

The second principle is like unto the first: *Most plants demand a particular season of inactivity or rest.* It is not rest in the sense of recuperation, but it is the habit or nature of the plant. For ages, most plants have been forced to cease their activities because of cold or dry. These habits are so fixed that they must be recognized when the plants are grown under glass. Some plants have no such definite seasons, and will grow more or less continuously, but these are the exceptions. Others may rest at almost any time of the year; but most plants have a definite season, and this season must be learned. In general, experience is the only guide as to whether a plant needs rest; but bulbs and tubers and thick rhizomes always signify that the plant was obliged, in its native haunts, to carry itself over an unpropitious season, and that a rest is very necessary, if not absolutely essential, under domestication. Instinctively, we let bulbous plants rest. They usually rest in our winter and bloom in our spring and summer, but some of them—of which some of the Cape bulbs, as nerines, are examples—rest in our summer and bloom in autumn.

The third principle from the plant side is this: *The greater part of the growth should be made before the plant is expected to bloom.* It is natural for a plant first to grow: then it blooms and makes its fruit. In the greater number of cases, these two great functions do not proceed simultaneously, at least not to their full degree. This principle is admirably illustrated in woody plants. The gardener always impresses on the apprentice the necessity of securing "well-ripened wood" of azaleas, camellias, and the like, if he would have good flowers. That is, the plant should have completed one cycle of its life before it begins another. From immature and sappy wood only poor bloom may be expected. This is true to a degree even in herbaceous plants. The vegetative stage or cycle may be made shorter or longer by smaller or larger pots, but the stage of rapid growth must be well passed before the best bloom is wanted. Fertilizer applied then will go to the production of flowers; but before that time it will make largely for the production of leaf and wood. The stronger and better the plant in its vegetative stage, according to its size, the more satisfactory it should be in its blooming stage.

Closely like the last principle is the experience that *checking growth, so long as the plant remains healthy, induces fruitfulness or floriferousness.* If the gardener continues to shift his plants into larger pots, he should not expect the best results in bloom. He shifts from pot to pot until the plant reaches the desired size; then he allows the roots to be confined, and the plant is set into bloom. Over-potting is a serious evil. When the blooming habit is once begun, he may apply liquid manure or other fertilizer if the plant needs it. The rose-grower or the cucumber-grower wants a shallow bench, that the plants may not run too much to vine.

A carnation-grower writes that there is "little difference in the yearly average as to quality or quantity of flowers, but plants grown on shallow benches come into flower more quickly in the fall. Those grown in solid beds produce an abundance of flowers later in the season. The preference of commercial carnation-growers is for raised benches so that there may be more blooms early in the fall and at the Christmas holidays."

The natural habitat of the plant is significant to the cultivator; it gives a suggestion of the treatment under which the plant will be likely to thrive. Unconsciously the plant-grower strives to imitate what he conceives to be the conditions, as to temperature, moisture and sunlight, under which the species grows in the wild. We have our tropical, temperate and cool houses. Yet, it must be remembered that the mere geography of a plant's native place does not always indicate what the precise nature of that place is. The plant in question may grow in some unusual site or exposure in its native wilds. In a general way, we expect that a plant coming from the Amazon needs a hothouse; but the details of altitude, exposure, moisture and sunlight must be learned by experience. Again, it is to be said that plants do not always grow where they would, but where they must. Many plants that inhabit swamps thrive well on dry lands.

Yet, the habitat and the zone give the hint: with this beginning, the grower may work out the proper treatment. Examples are many in which cultivators have slavishly followed the suggestion given by a plant's nativity, only to meet with partial failure. Because the dipladenia is Brazilian, it is usually supposed that it needs a hothouse, but it gives best results in a coolhouse. Persons often make a similar mistake in growing the pepino warm, because it is Central and South American. Ixia is commonly regarded in the North as only a glasshouse subject because it is a Cape bulb, yet it thrives in the open in parts of New England, when well covered in winter.

The best method of propagation is to be determined for each species; but, as a rule, quicker results and stockier plants are secured from cuttings than from seeds. Of necessity, most greenhouse plants are grown from cuttings. In most cases, the best material for cuttings is the nearly ripe wood. In woody plants, as camellias and others, the cutting material often may be completely woody. In herbaceous plants, the proper material is stems which have begun to harden. Now and then better results are secured from seeds, even with perennials, as in grevillea and *Impatiens Sultani.*

Coming, now, to some of the principles that underlie the proper management of the house, it may be said, first of all, that the grower should *attempt to imitate a natural day.* There should be the full complement of continuous sunlight; there should be periodicity in temperature. From the lowest temperature before dawn, there should be a gradual rise to midday or later. As a rule, the night temperature should be 10° to 15° F. below the maximum day temperature in the shade. A high night temperature makes the plants soft and tends to bring them to maturity too early. It makes weak stems and flabby flowers. The temperature should change gradually: violent fluctuations are inimical, particularly to plants grown at a high temperature.

In greenhouse cultivation, *every plant is to receive individual care.* In the field, the crop is the unit: there we deal with plants in the aggregate. In the greenhouse, each plant is to be saved and to receive special care: upon this success depends. There should be no vacant places on the greenhouse bench; room is too

valuable. All this means that every care should be taken so to arrange the house that every plant will have a chance to develop to its utmost perfection. Patient hand labor pays with greenhouse plants. The work cannot be done by tools or by proxy. Therefore, the gardener becomes skilful.

Every caution should be taken to *prevent the plants from becoming diseased or from being attacked by insects.* The greater part of insect and fungous troubles in the greenhouse is the result of carelessness or of mistakes in the growing of the plants. Determine what diseases or pests are likely to attack any plant; discover under what conditions these diseases or pests are likely to thrive; then see that those conditions do not arise. Keep the house sweet and clean. Destroy the affected parts whenever practicable. Then if trouble come, apply the fungicide or the insecticide. Remember that the very protection which is given the plants, in the way of equable conditions, also protects their enemies: therefore, it is better to count on not having the difficulties than on curing them. If uncontrollable diseases or pests have been troublesome, make a complete change of soil or stock before the next season, if practicable. At least once every year there is an opportunity to rid the place of pests. Nematodes may be frozen out. Many gardeners carry their troubles year by year by trying to fight them, when they might succeed by trying to avoid them.

Of course, the greenhouse man must provide himself with the best insecticides and fungicides, and with good apparatus. The efficiency of these materials and appliances has greatly improved in recent years, and most of the old pests may now be controlled.

The higher the temperature and the more rapid the growth, the greater the care necessary to insure good results. Plants grown under such conditions are soft and juicy. They are easily injured by every untoward circumstance, particularly by drafts of cold air. Let a draft of cold air fall on cucumbers or rapid-growing roses, and mildew will result in spite of bordeaux mixture and brimstone.

In dark weather, grow the plants "slow." If given too much heat or too much water, they become soft and flabby, and fall prey to mildew, green-fly and other disorders. A stocky plant is always desirable, but particularly in the dull weather and short days of midwinter: at that time, extra precautions should be taken in the management of the house.

Watering plants under glass requires more judgment than any other single operation. *Apply water when the plants need it,* is a gardener's rule, but it is difficult to follow because one may not know when they need it. Yet, if the gardener will put the emphasis on the word *need* he will at least be cautioned: novices often apply the advice as if it read: Apply water when the plants will stand it. *Water thoroughly at each application.* Mere dribbling may do more harm than good. Many persons water too frequently but not enough. Remember that in benches evaporation takes place from both top and bottom; and in pots it takes place from all sides. *Water on a rising temperature.* This advice is specially applicable to warmhouse stuff. Watering is a cooling process. *The foliage should not go into the night wet,* particularly if the plant is soft-growing or is a warmhouse subject. *Water sparingly or not at all when evaporation is slight,* as in dull weather.

In all greenhouse work, *see that the soil is thoroughly comminuted and that it contains much sand or fiber.* The amount of soil is small: see that it is all usable. In the garden, roots may wander if good soil is not at hand: in pots they cannot. The excessive watering in greenhouses tends to pack the soil, particularly if the water is applied from a hose. The earth tends to run together or to puddle. Therefore, it should contain little silt or clay. The practice of adding sand and leaf-mold to greenhouse soil is thus explained.

Ventilation is practised for the purpose of reducing temperature and of lessening atmospheric moisture. Theoretically, it is employed also for the purpose of introducing chemically fresh air, but with the opening and shutting of doors, and unavoidable leaks in the house, it is not necessary to give much thought to the introduction of mere fresh air. Ventilating reduces the temperature by letting out warm air and letting in cool air. The air should be admitted in small quantities and at the greatest distance from the plants in order to avoid the ill effects of drafts on the plants. Many small openings are better than a few very large ones. Ventilate on a rising temperature.

Most plants require shading in the summer under glass. *Shading is of use in mitigating the heat as well as in tempering the light.* A shaded house has more uniform conditions of temperature and moisture. If plants are grown soft and in partial shade, they are likely to be injured if exposed to bright sunlight. Sunscalding is most common in spring, since the plants are not yet inured to bright sunshine and strong sun heat. The burning of plants is due to waves (not bubbles) in the glass. Other things being equal, the larger the house the easier is the management of it. It is less subject to fluctuations of temperature and moisture. Greenhouses built against residences are specially liable to violent fluctuations; the body of air is small and responds to all external changes. L. H. B.

GREENS, CHRISTMAS. The Christmas greens industry has developed to an enormous extent within a few years. Some thirty years ago, when florists began to use lycopodium, a dozen barrels were all that was used in a single season in many of our larger cities. Today the output in the United States is many full carloads.

The materials now used, mentioned in something like their order of commercial importance, are holly, lycopodium (also known as bouquet green, ground pine, club moss), mistletoe, laurel, and cedar clippings. Other articles of similar utility are wild smilax, hardy ferns, needle pines, outdoor palm leaves, Florida moss, galax leaves and leucothoë sprays: these all come from the South.

Lycopodium is one of the oldest and commonest of decorative materials. During seasons of long-continued "Indian summer," a surplus is frequently gathered by careless pickers and thrown on the market. The choicest picked stock being obtainable only through the regular and well-established trade channels, such sources are usually the only ones in case of early snowstorms, which prevent the gathering of it. Choice stock from eastern Vermont, northern New York and Pennsylvania has usually been handled in large sugar-barrels, tied in carefully arranged bunches, weighing perhaps one-half to one pound each. These bunches are packed in the barrels in layers, with roots toward the center. The quantity is always limited and the price 25 to 35 per cent higher than the Wisconsin and Michigan stock. Lycopodium, as placed on the market from western sources, comes from the north-central part of the state of Wisconsin and is gathered mainly in the section extending from the northwest shores of Lake Michigan three-fifths of the way to the Mississippi River. The activities in this direction are conducted mainly in Oconto, Shawano, Marathon, Langlade, Lincoln, Forest, Oneida, Taylor, Price and Vilas Counties. The section from which lycopodium is picked annually moves northward as the country becomes settled and as the woods and swamps are depleted. This article is also gathered in a few spots in the northern peninsula of Michigan, and in Pine, and Carleton Counties in Minnesota. Surplus stock of this plant is sometimes carried over until the following season when it is soaked and dyed green and made up into wreathing. The same article carried over from

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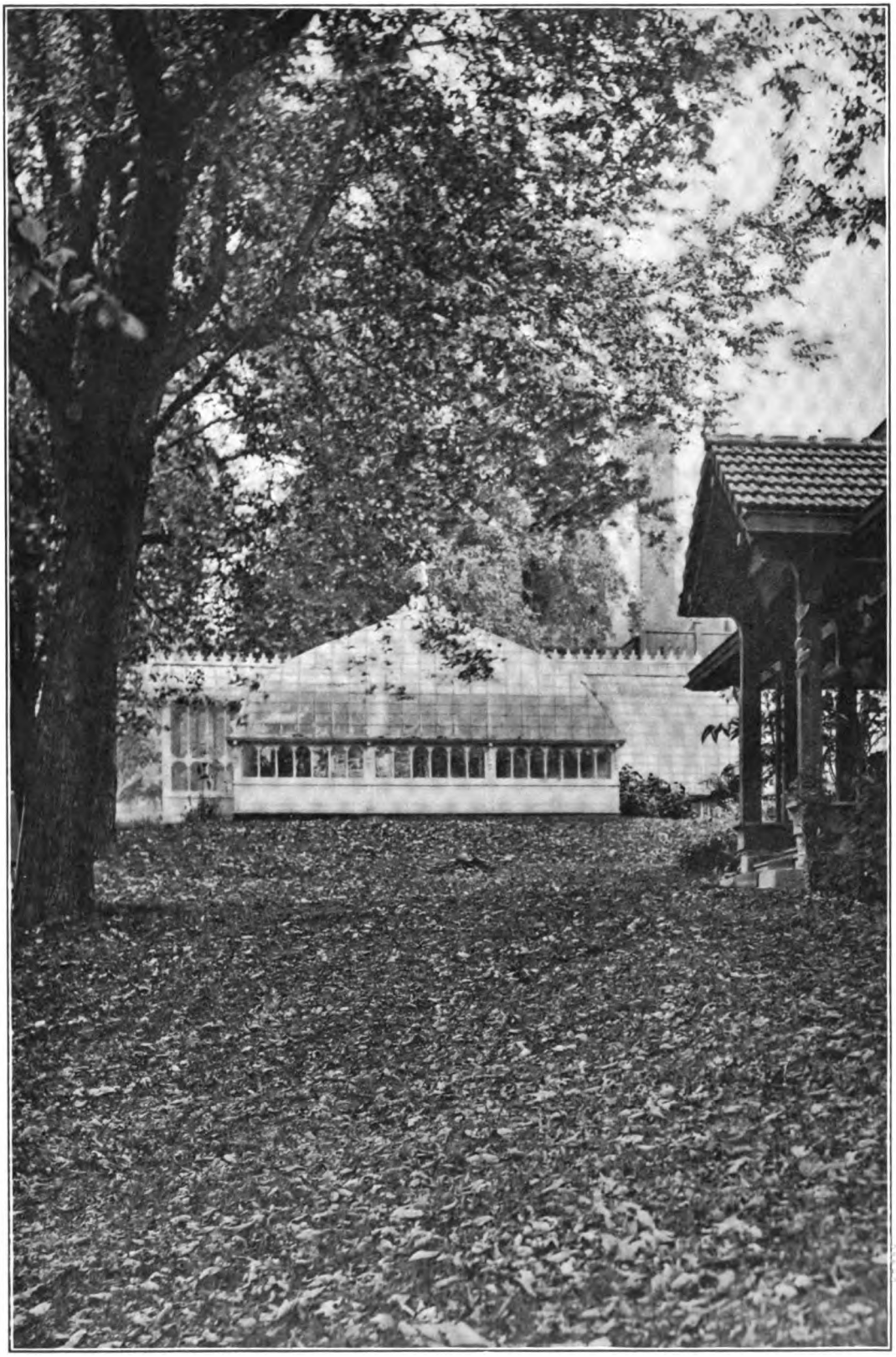

LI. A home greenhouse.

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Christmas in the usual 100-pound crates loses its fresh color and dries down to a weight of about fifty pounds. There is some foreign demand for this plant in the German cities for use in the artificial-flower trade. This plant seems to thrive best in moist, shaded localities, and when plucked out by the roots, as is done when gathering, is not replaced by new growth of its kind. More open situations and drier ground produce lycopodium of a lighter and yellowish color, and consequently of less decorative value. Indians pick the best green, but are unreliable when exact dates must be met. The average season's output from Wisconsin is perhaps thirty-five carloads, or 150 to 200 tons.

The use of holly in a commercial way has grown from a very small beginning to its present proportions within fifteen years. Until the last twenty years most of the holly was handled by wholesale seedsmen and florists. Within that time the sale of holly has been taken up by the produce commission houses in large cities, thereby trebling the volume, but reducing the quality. Delaware and Maryland furnish the best stock of what is known as eastern holly, while Tennessee and some other parts of the South ship what is usually an inferior quality. Holly is almost always packed in uniform cases 2 by 2 by 4 feet. Freezing, while packed in cases, damages it but little, provided the holly be allowed to thaw out in a very cool and preferably dark place, where the temperature is not allowed to exceed 45° F. If, however, frozen holly is shipped in warm express cars, the foliage may turn black in a night. English holly has occasionally been imported into the United States and into Canada, but never satisfactorily commercially. For red winter berries, *Ilex verticillata*, a deciduous holly which grows in large quantities in Michigan, is now a much-sought decorative material.

Both holly and lycopodium are becoming more scarce every year, and the market has probably advanced permanently 20 to 30 per cent in the last two or three years.

Mistletoe branches as used in America (a very little is imported from France) are collected chiefly in New Mexico and Oklahoma, and small quantities from Tennessee, Kentucky or Arkansas. It is now usual to ship this in heavy pasteboard cases containing twenty-five to fifty pounds. The western or central states probably use 15,000 to 20,000 pounds from the states mentioned. Mistletoe is easily very seriously injured from freezing in transit.

Cedar clippings are now but little used during the holiday season, but on other occasions, when open-air decorations are desired, they are frequently made into roping or wreaths.

Wild smilax, in light cases, usually in three sizes, is shipped by express mostly from Alabama and Georgia. It is as liable to injury by freezing as mistletoe, but is not damaged if allowed to thaw out gradually before removal from the case. The use of this article by the wholesale cut-flower dealers is increasing. There is probably $20,000 worth used annually and some carload shipments are made. It is readily perishable and the wholesale dealers put it in ice storage where it keeps for two to three weeks. They do not usually keep it in stock except during the holiday season.

Boxwood clippings of lengths from 12 to 18 inches have become quite an article of commerce. These are gathered from Maryland, Virginia, West Virginia and other similar localities and are used mainly in the cut-flower trade for making wreaths and for mixing with fresh flowers. The gathering and shipping of this article for the above purpose was begun four or five years ago. The trade has increased rapidly and perhaps fifty tons or more were used in 1911. It will probably take but a short time to exhaust the old gardens where this plant has been growing in the sections mentioned, as it is not to be had except around old homesteads where it was planted years ago.

The use of laurel is increasing largely during the past five years and it is now shipped from Maryland, Delaware, Virginia and New Jersey, both in bulk in short sprays in cases, similar to those used in holly cases, and in wreathing in coils usually containing 100 yards. Shipments are made from the above sections to the northern and western states.

Hardy ferns are also marketed through the wholesale cut-flower merchants. These are gathered in Massachusetts and Michigan and kept in storage the entire year, not being so perishable as wild smilax. Wisconsin is now producing as many ferns as Michigan, or perhaps more.

Among the most artistic materials for Christmas decoration are galax leaves and leucothoë sprays. Galax grows in the mountains from North Carolina to Georgia, and nowhere else in the world.

For further particulars concerning this industry, see American Florist 14:598–600 (1898). For the artistic side of Christmas decoration, see illustrated articles by F. Schuyler Mathews in American Florist 8:484 and 9:493.

J. C. VAUGHAN.

GREENS, EDIBLE, or POT-HERBS. This term greens is generally applied in America to any pot-herb, that is to say, to any green herbage which is cooked and served separately from the other principal and secondary dishes of a square meal. The term "greens" is commonly used for the mess of cookery which is brought to the table. It is not so often applied to the plants growing in the garden. In the garden, perhaps, they are herbs—pot-herbs—although this term is not so much employed as it conveniently might be. Greens are served early in the spring, when the appetite craves anything which tastes like out-of-doors.

All sorts of plants are used as pot-herbs. Almost anything which shows a succulent growth in the spring is likely to be tried by somebody. Turnip tops, potato leaves, pig-weeds, purslane, and many other apparently impossible herbs, are often impressed into the service. The really good pot-herbs are comparatively few, however. Probably the best are dandelion, spinach, mustard (various species), endive, chard, beet-top and kale.

The following plants have been more or less used as pot-herbs:

Buck's-horn Plantain, *Plantago Coronopus.*
California Peppergrass, *Brassica japonica.*
Cardoon, *Cynara Cardunculus.*
Chard, *Beta vulgaris.*
Chervil, *Anthriscus Cerefolium.*
Chicory, *Cichorium Intybus.*
Chinese Amaranth, *Amarantus gangeticus.*
Chinense Artichoke, *Stachys Sieboldii* (*S. affinis* or *S. tuberifera*).
Chinese Cabbage, *Brassica Pe-tsai.*
Chinese Cabbage, *Brassica chinensis.*
Chinese Mustard, *Brassica juncea.*
Chives, *Allium Schoenoprasum.*
Corn Salad, *Valerianella olitoria.*
Cress, *Lepidium sativa.*
  Meadow Cress, *Cardamine pratensis.*
  Pará Cress, *Spilanthes oleracea.*
  Upland Cress, *Barbarea vulgaris* and *B. præcox.*
  Other so-called Cresses, as *Lepidium chilense, Lepidium piscidium, Lepidium virginicum, Senebiera pinnatifida, Nasturtium indicum, Gynandropsis pentaphylla.*
Dandelion, *Taraxicum officinale.*
Dock, *Rumex*, several species.
Endive, *Cichorium Endivia.*
Globe Artichoke, *Cynara Scolymus.*
Good King Henry, *Chenopodium Bonus-Henricus.*
Goosefoot, *Chenopodium*, mostly *C. album.*
Ice Plant, *Mesembryanthemum crystallinum.*
Italian Corn Salad, *Valerianella eriocarpa.*
Kale, *Brassica oleracea.*
Lettuce, *Lactuca* (especially the wild species, some of which are excellent).
Malabar Nightshade, *Basella alba* and *Basella rubra.*
Mustard, *Brassica* species.
Nasturtiums, *Tropæolum* species.
Orach, *Atriplex hortensis.*
Parsley, *Petroselinum.*
Pepper-grass, *Lepidium* species.
Pigweed, *Amarantus* species.
Pokeweed, *Phytolacca decandra.*
Quinoa, *Chenopodium Quinoa.*
Rocket Salad, *Eruca sativa.*

Rosella, *Hibiscus Sabdariffa.*
Salad-Burnet, *Porterium Sanguisorba.*
Sorrels, various, *Oxalis crenata, O. tetraphylla.*
Spinach, *Spinacia oleracea.*
Tuberous-Rooted Chinese Mustard, *Brassica napiformis.*
Turnip, *Brassica Rapa.*
Winter Purslane, *Montia perfoliata.*

Culture.—Pot-herbs are wanted at the earliest possible moment in the spring. They are, therefore, often grown in hotbeds, frames, or in greenhouses (see *Spinach, Dandelion, Mustard,* etc.). They must be succulent and tender. It is necessary, on this account, that they be quickly grown in loose, very rich, well-drained soil, with plenty of water. Specific directions for the cultivation of the various plants will be found under the several heads. F. A. WAUGH.

GREGÒRIA: *Douglasia.*

GREÌGIA (Major-General Greig, Russian horticulturist). *Bromeliàceæ.* A few species of large Andine, terrestrial or rock-loving herbs, allied to Cryptanthus, from which it differs in its simple rather than panicled infl. Fls. perfect; sepals free or lightly joined at the base, linear or ovate-lanceolate or almost subulate; perianth with free elliptical segms. rounded at apex; stamens shorter than petals or scarcely exceeding them; petals rose-color or white suffused with rose, becoming brownish. **G. sphacelàta,** Regel (*Billbérgia sphacelàta,* R. & S. *Bromèlia sphacelàta,* Ruiz & Pav.). Stout pineapple-like plant, 3 ft., with strong spiny-margined spreading or recurving lvs.: fls. rose-color, in dense heads in the axils of the lvs., the outer bracts spiny and very acute. Summer. Chile.—A showy plant. L. H. B.

GRENADIN or GRENADINE: A type of carnation.

GREVÍLLEA (Charles F. Greville, once vice-president of the Royal Society of England, and a patron of botany). *Proteàceæ.* Trees and shrubs, of about 200 species, mostly Australian, one of which is commonly cultivated in this country as a decorative pot-plant and also in the open in southern California and elsewhere in warm regions.

Leaves alternate, very various: fls. small, perfect, mostly in pairs in the clusters or racemes, apetalous, the calyx with 4 recurved parts; stamens of 4 sessile perfect anthers borne on the sepals; style 1, long and curved: fr. a follicle, with 1 or 2 winged orbicular or oblong flat seeds. The fls., sometimes showy and ornamental, are terminal and axillary, the racemes sometimes umbel-like. The fls. of some species produce honey. Some species yield useful timber.

A. *Racemes secund, many-fld.: lvs. much cut or compounded.*

robústa, Cunn. SILK OAK. Fig. 1768. One of the most popular of all fern-leaved pot-plants. When young (from 2–5 ft. high) it makes a most graceful subject. In glasshouses it is not grown to large plants, and, therefore, little is known of the great size which it attains in its native forest. According to Von Mueller, it is "indigenous to the subtropical part of E. Austral., rising to 150 ft., of rather rapid growth, and resisting drought to a remarkable degree; hence one of the most eligible trees even for desert culture, though naturally a sylvan plant. The wood is elastic and durable, valued particularly for staves of casks, also for furniture. The richly developed golden yellow trusses of fls. attract honey-sucking birds and bees through several months of the year. The seeds are copiously produced and germinate readily. Rate of growth in Victoria, 20–30 ft. in 20 years. In Ceylon it attained a stem-circumference of 5 ft. in 8 years." In Calif. and S. Fla. it is a street lawn tree, although the branches break easily in exposed places. When grown in the open, it will stand some frost. As a glasshouse plant it is grown almost wholly from seeds, and is used in its young state; as the plant becomes old, it loses its leaves and becomes ragged below. It thrives in the temperature suited to geraniums or roses, and it stands much hard usage and neglect. It is popular as a window subject. Best results with grevillea are usually secured by raising a fresh stock every year, from seed sown late in winter or in spring. The following winter or spring they will be in 4–6 in. pots, and will be in their prime. The young plants need frequent repotting to keep them in good condition. *Grevillea robusta* has come to be generally known as a florists' plant within the past thirty years. Lvs. twice-pinnatifid (or the pinnæ deeply pinnatifid), or nearly 3-pinnate under cult., the ultimate divisions narrow and pointed and sometimes lobed, pubescent: racemes 3–4 in. long, solitary or several together on short leafless branches of the old wood; fls. orange, glabrous, the tube ¼in. long, the parts revolute: fr. about ¾in. long, broad, very oblique. B.M. 3184. G. 2:615; 8:680. G.L. 24:40. A.G. 14:115. A.F. 4:413.—In the W. Indies the plant is much grown, and it is often trimmed to desired shape. In exposed places the foliage becomes golden in cast. Var. **compácta,** Hort., is a condensed dwarf form with handsome foliage, G.C. III. 49:375. G.M. 54:452. G. 33:393. F. E.

1768. Grevillea robusta. (×⅙)

31:1259. Var. **pyramidàlis,** Hort., is offered abroad. Var. **Fórsteri** (*G. Fórsteri,* Hort.) is a form of *G. robusta.* It has silvery foliage, large trusses of deep bright red fls., and much stronger growth. R.B. 24:3.

Thelemanniàna, Hueg. (*G. Preissii,* Meissn.). Spreading shrub, the young growths soft-tomentose: lvs. 1–2 in. long, pale or glaucous, pinnate, the lower pinnæ usually divided, segms. linear: racemes terminal, rather dense, 1½ in. or less long; fls. pink with green tips, few-hairy outside and bearded inside, the tube about ¼in. long: fr. about ½in. long, smooth. B.M. 5837. R.H. 1882:456. J.H. III. 42:497. H.U. 6:193. G.W. 5:499.—Now popular in Calif.

Bánksii, R. Br. Tall shrub or slender small tree, with branches rusty-tomentose: lvs. 4–8 in. long, pinnate or deeply pinnatifid, the segms. 3–11 and broad-linear or lanceolate, margins revolute: racemes terminal, erect and dense, 2–4 in. long; fls. red, tomentose outside and glabrous inside: fr. about 1 in. long, obliquely ovate. B.M. 5870. G.C. III. 16:15.—Offered abroad.

AA. *Racemes not secund, dense and usually short, sometimes panicled: lvs. less divided, often only lobed.*

Hilliàna, F. Muell. Large tree, with minutely tomentose young branches: lvs. 6–8 in. or more long, sometimes entire and obovate-oblong or elliptical and very obtuse, sometimes deeply divided or even pinnati-

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fid: fls. red, small and very many in dense cylindrical racemes 4–8 in. long, silky outside, glabrous or nearly so inside: fr. nearly 1 in. long, slightly compressed. B.M. 7524.—Pink and white varieties are mentioned.

glabràta, Meissn. (*G. Mánglesii,* Hort.). Shrub, glabrous, slender: lvs. 1–1½ in. long, broadly cuneate, shortly and acutely 3-lobed: fls. white, in axillary racemes equaling the lvs. or the upper racemes panicled, the perianth glabrous, the tube much exceeding the globular limb.—Offered abroad as a bright green ornamental foliage plant of drooping habit.

There are no other grevilleas in the American trade, but following are accessible portraits of other species: *G. acanthifòlia,* Cunn. B.M. 2807.—*G. alpéstris,* Meissn. (G. alpina var. Lindl.). B.M. 5007. R.H. 1887:108. R.B. 23:145.—*G. annulífera,* Muell. B.M. 6687.—*G. arenària,* R. Br. (G. canescens, R. Br.). B.M. 3185.—*G. aspleniòlia,* Knight. B.M. 7070. R.H. 1882, p. 245 (as G. longifolia).—*G. bipinnatífida,* R. Br. B.M. 8510.—*G. Càleyi,* R. Br. B.M. 3133.—*G. canéscens,* R. Br.=G. arenaria.—*G. ericifòlia,* R. Br. B.M. 6361.—*G. fasciculàta,* R. Br. B.M. 6105.—*G. Hookeriàna,* Meissn. B.M. 6879.—*G. intricàta,* Meissn. B.M. 5919.—*G. juniperìna,* R. Br. (G. sulphurea, Cunn.). G.C. II. 26:469.—*G. lavanduldcea,* Schlecht. (G. rosea, Lindl.). I.H. 2:61. J.F. 3:288.—*G. linearis,* R. Br. B.M. 2861.—*G. longifòlia,* R. Br.=G. aspleniifolia.—*G. macróstylis,* Muell. B.M. 5915.—*G. pulchélla,* Meissn. B.M. 5979.—*G. puntcea,* R. Br. B.M. 6698.—*G. rosmarinifòlia,* Cunn. B.M. 5971. G.C. II. 5:529. G. 35:389.—*G. sericea,* R. Br. (G. dubia, R. Br.). B.M. 3798.—*G. sulphùrea,* Cunn.=G. juniperina.

L. H. B.

GRÈWIA (Nehemiah Grew, of Coventry, 1628–1682, author of a work on anatomy of plants). *Tiliàceæ.* Two or three woody plants slightly cultivated in southern Florida.

A genus of about 70 species of trees and shrubs in the warmer parts of the world, often having stellate pubescence: lvs. entire or serrate, 1–9-nerved: fls. yellow or rarely purple, in axillary, few-fld. cymes or terminal panicles; petals 5, with pits or glands inside at the base; stamens indefinite; ovary 2–4-celled: drupe 1–4-stoned. **G. Càffra,** Meissn., from Natal, was intro. by Reasoner Bros. in 1891. A bushy plant with young shoots and lvs. glabrous and with purple star-shaped fls. borne during most of the year. **G. denticulàta,** Wall., from India, was never described. Under this name Reasoner cult. a plant "resembling a mulberry in growth, which bears enormous quantities of acid drupes, about the size of cranberries; used for pickling." **G. oppositifòlia,** Roxbg., is a rough, much-branched tree, with distichous, crenate-serrate lvs. and fls. in umbellate cymes, borne opposite the lvs.: fls. yellowish, the oblong petals half the length of the sepals. The species are little known in Amer.

N. Taylor.†

GRÈYIA (after Sir George Grey, once Governor of Cape Colony). Often spelled *Greya. Melianthàceæ.* A small tree from Natal, which bears large spikes of pendulous, five-petaled, scarlet flowers, and is cultivated outdoors in southern California and abroad under glass in many botanic gardens.

Species probably 3, but only 1 appears to be in cult.; in R.H. 1894:252 this plant is shown at its best, with a spike 6 in. long and 2–3 in. wide, containing probably over 100 fls., each ¾in. across. In France this tree flowered from the end of autumn throughout the winter. The long-exserted stamens with reddish purple anthers make a striking feature. The structure of the fls. is so peculiar that Harvey referred the genus doubtfully to the saxifrage family. In European greenhouses, greyia is a shrub requiring full sunlight, thorough ripening of the wood and a season of rest before flowering. In Natal it flowers in Aug. or Sept., which is early spring there. Europeans recommend a sandy loam. Prop. by seeds or by cuttings from half-ripened wood.

Sútherlandii, Hook. & Harv. Small tree, with thick, naked branches and light-colored bark: lvs. clustered at the ends of the branches, 2–3 in. long, orbicular, ovate or oblong, deeply cordate at base, toothed; petiole 9–12 lines long: fls. bright crimson; disk cup-shaped, with 10 marginal teeth, each crowned by a peltate gland; stamens 10; ovary laterally 5-lobed, 5-celled; ovules numerous, in 2 series in the inner angle of the cells: fr. capsular, 5-valved; seeds albuminous. B.M. 6040. R.H. 1894:252. G.C. II. 19:625; III. 43:138. J.H. III. 30:101.

N. Taylor.†

GRÌAS (name refers to the fr. being edible). *Lecythidàceæ.* Tall W. Indian trees, with branches short or none and very large alternate simple lvs., one of them known for its edible fr.: fls. large, white or yellow, lateral; calyx entire in bud, but becoming 2–4-lobed or torn; petals spreading, 4 or 5; stamens many, in many or several rows on the disk, the inner ones smaller, the fleshy filaments conniving into a globular involute body, the anthers small and the cells distinct: fr. fleshy, ovoid.—Species about 4. *G. cauliflòra,* Linn., produces the Anchovy pear: lvs. 2–4 ft. long, lanceolate-acuminate, entire, drooping, glossy, borne in palm-like tufts or heads on the top of the st. or ends of branches.: fls. on short branching peduncles from the old st. far below the lvs., fragrant, 2 in. across, yellow: fr. ovoid, 2–3 in. long, 8-grooved, brown, fleshy, with 1 seed, said to be edible. W. Indies. B.M. 5622.

L. H. B.

GRIFFÍNIA (after William Griffin, who brought these plants from Brazil). *Amaryllidàceæ.* Brazilian bulbs, with distinct foliage, and flowers, about 2½ inches across, which are more or less tinged with lilac or rose.

Leaves usually petioled, and with a very broad blade: perianth-tube none or very short, the 3 lower segms. narrower than the upper; ovary 3-celled; stigma capitate, rarely 3-fid; umbel 6–15-fld. Griffinia is distinguished from many other genera by its 2 ovules, which are basal and collateral.—Seven species. Like many other genera of the amaryllis family, bulbs of flowering size are too costly for general use. Very doubtfully in cult. in Amer.

A. *Stigma capitate.*

hyacínthina, Herb. Bulb globose: lvs. 6–9 in. long, 2–3 in. broad, rounded at the base to a channeled petiole as long as the blade: scape 1–2 ft. long; pedicels none or very short; stamens much shorter than the segms. B.R. 163 (as *Amaryllis hyacinthina;* upper segms. tinged blue, lower ones nearly white). J.H. III. 31:371; 55:325. G.M. 47:45. Var. **máxima,** Gn. 50, p. 209, is probably the best garden form. Called "blue amaryllis" in some catalogues.

AA. *Stigma distinctly 3-cut.*

Blumenàvia, Koch & Bouché. Bulb ovoid: lvs. 4–5 in. long, cuneately narrowed to a petiole, shorter than the blade: scape 6–8 in. long; pedicels ½in. long; stamens as long as the perianth. B.M. 5666 (veins rose-colored). R.H. 1867:32. Gn. 50:208 (veined and flushed with rose).

N. Taylor.†

GRINDÈLIA (Hieronymus Grindel, of Riga and Dorpat; died 1836). *Compósitæ.* Hardy plants sometimes cultivated for their showy yellow flowers, which are 1½ to 2 inches across and borne freely all summer.

Herbs, sometimes shrubby, of coarse habit, mostly natives of the U. S. west of the Mississippi: lvs. sessile or partly clasping and usually serrate and rigid: heads terminating the branches, solitary or in cymes or panicles; involucre bell-shaped or hemispheric, the bracts many-ranked. The plants often have a sticky balsam, especially the heads before and during flowering, whence they are called "gum-plants" in Calif., particularly *G. robusta,* which is the common one. The two species first described below have roots that are perennial and short-lived, but sometimes annual. These plants are also glabrous, and have firm or rigid lvs. This genus contains 2 plants from which a fluid-extract is obtained that is used externally as an antidote for poisoning by "poison ivy."—Species about 25.

Grindelias are of the easiest culture. They are propagated by division, cuttings or seed. *G. squarrosa* is hardy in the East: *G. robusta* is sold in California. They are best for wild places and trying situations. *G. squarrosa* grows freely in all soils but it does best in a light, open, moderately rich soil. In California it is common on dry hills. According to John S. Wright, both species grow in salt marshes and on alkaline soil, being indiscriminately gathered for medicinal purposes. The extract is also tonic and sedative, and is used in asthma. The rays are numerous, sometimes thirty, about ½-inch long.

squarròsa, Dunal. Shrubby, smooth, branched from base, 1–2 ft. high: lvs. dark or bluish green with clasping bases: fl.-heads sticky: outer achenes usually squarely truncate and even at summit. Manitoba to Mex. B.M. 1706 (as *Donia squarrosa*). Mn. 10:145.

robústa, Nutt. GUM-PLANT. Herbaceous: lvs. larger and more rigid, broadly cordate-oblong, obtuse: achenes all, or some outer ones, 1-toothed or bordered at the summit.—Flowers throughout the Californian winter. Collected stock is offered.

pàtens, Greenm. (*G. robústa* var. *pàtens*, Gray). A stiff erect perennial with many single-headed branches: lvs. rough-hairy, narrowly oblanceolate, toothed: heads about 1 in. wide, the achenes thin, obcordate at the summit. Calif. G.C. III. 27:59.

WILHELM MILLER.
N. TAYLOR.†

GRISEBÁCHIA: *Howea.*

GRISELÌNIA (after Franc Griselini, Venetian botanist, middle of eighteenth century). Including *Decóstea*. *Cornàceæ*. Woody plants with large, glossy, laurel-like foliage, rarely cultivated in the South, and nearly hardy at Washington.

Trees, shrubs or climbers from New Zeal., Chile and Brazil, with lvs. alternate, often unequal-sided, thick and leathery: fls. minute, in glabrous or pubescent racemes or panicles; calyx very small, 5-toothed, the petals 5, imbricated; stamens 5, with subulate filaments: fr. baccate, 1- or rarely 2-celled.—Six or seven species. Related to Garrya, from which it differs in the alternate lvs. Little cult. in Amer.

littoràlis, Raoul. Tree, 30–50 ft. high, with brown-hairy twigs: lvs. ovate or oblong, wedge-shaped or narrowed into a petiole; veins obscure beneath: fls. in axillary panicles, equaling or slightly shorter than the lvs. New Zeal. G.W. 14, p. 323.

lûcida, Forst. f. Shrub, 3–25 ft. high: lvs. obovate or oblong, very unequal at the base; veins distinct beneath: fls. in axillary panicles, usually shorter than the lvs. New Zeal. Not cult. in Amer. Var. **macrophýlla** (*G. macrophýlla*, Hort.), is a large, more orbicular-lvd. form.—*G. lucida* is prized in Eu. for apartments or residences. Showy. Requires shade and moisture. Sometimes epiphytic. N. TAYLOR.†

GROMWELL: *Lithospermum.*

GROSSULÀRIA (from *grossulus*, a small fig, from the resemblance of the fruit). *Saxifragàceæ*. An old name for the gooseberries recently (N. Amer. Fl. 22, pt. 3. 1908) reinstated by Coville and Britton as a genus coördinate with Ribes, the currants. As distinguished from Ribes, Grossularia is defined by the flowers having an evident hypanthium or cup-shaped receptacle, the pedicels not jointed and the fruit not disarticulating, different disposition of bractlets on the pedicel, and the plants bearing spines at the nodes. Under this disposition, the English gooseberry becomes *G. reclinàta*, Mill. or *G. Uvacrispa*, Mill., and the native gooseberry of the Downing type is *G. hirtélla*, Spach. See *Ribes*. L. H. B.

GROUND CHERRY: *Physalis;* in the Old World *Prunus Chamæcerasus*. **Ground Hemlock** or American yew: *Taxus canadensis*. **Ground Ivy:** *Nepeta Glechoma*. **Ground Laurel:** Old World name for *Epigæa repens*. **Groundnut:** *Apios* and *Panax;* also Old World name for peanut or goober (*Arachis*). **Ground Pine:** *Lycopodium*. **Ground Pink:** *Phlox subulata*.

GROUNDSEL: *Senecio*. **Groundsel Tree:** *Baccharis halimifolia*.

GRUMICHÀMA: *Eugenia brasiliensis*.

GUÀIACUM (W. Indian name). *Zygophyllàceæ*. Guaiacum (gwaí-a-cum) is kept in drugstores, and the tree which produces the resin used in medicine has a hard, heavy wood. Both the species below are the source of the lignum-vitæ of commerce which is used so extensively for blocks and pulleys, rulers, and the like. It is cult. to a very slight extent in S. Calif. and in Trop. Fla. for ornamental value. The genus has about 4 species of trees or shrubs, Trop. American, and all have hard wood and abundant resin: lvs. opposite, abruptly pinnate, leathery; lfts. 2–14, entire: peduncles borne in pairs between the deciduous stipules, 1-fld.; fls. blue or purple, not showy; sepals 4–5,

1769. Cattley guava. (×½)

deciduous, unequal; petals 4–5, broadly obovate; stamens 8–10, inserted in the short, inconspicuous disk.

officinàle, Linn. Middle-sized or low tree, inhabiting arid plains from the Fla. keys to Venezuela: lfts. in pairs, evergreen, ¼–½in. long, obovate or oval, blunt: sepals oval, hairy, thrice exceeded by the petals.

sánctum, Linn. Similar in aspect, but the lvs. obliquely lanceolate-elliptic, and the smooth sepals about half as long as the petals. W. Indies.—Not much cult. in Amer. The wood of both species is very valuable. N. TAYLOR.†

GUAR. An annual forage plant (*Cyamopsis tetragonoloba*, Taub.), of the Leguminosæ, has been tried somewhat in this country with promise. It appears to be adapted to the warmer parts of the country, requiring about the same conditions as the cowpea. It is from India.

GUAVA. The name guava is applied to the fruit of various species of Psidium, frequently with the addition of a qualifying word such as apple, pear, Cattley, to distinguish different species and varieties. In Spanish it is guayaba, in Portuguese goiaba, and in French goyave (the plant goyavier). In Brazil the name araça, with qualifying words, is applied to a number of wild species.

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The common guava of the tropics is *Psidium Guajava*, Linn., of which there are numerous varieties. Although the native home of this species is in tropical America, it is now widely distributed throughout the warmest regions of the globe. Under favorable conditions it becomes a tree 25 to 30 feet in height; its bark is smooth, greenish brown in color, while the leaves are opposite, oval, smooth, light green, the veins depressed above and prominent below. The flowers, which are produced in the axils of the leaves, are about an inch in diameter, with four incurved white petals and a large tuft of white stamens tipped with yellowish anthers.

The fruit varies in shape from spherical to pyriform, and in diameter from 1 to 4 inches. Commonly it is oval or slightly pyriform, and about 2 inches in diameter. The thin light yellow skin surrounds a layer of finely granular pulp, inside of which is a mass of softer pulp in which the small hard seeds are embedded. The color of the flesh varies from white through shades of salmon to deep pink, according to the variety; its flavor when fully ripe is sweet or slightly acid, and nearly always somewhat musky. The aroma is characteristic and rather penetrating; while objectionable to some persons it is very agreeable to others.

The fruit is eaten in many ways,—out of hand, sliced with cream, stewed, preserved, and in shortcakes and pies, but it is most highly valued for the manufacture of jams and jellies. In several tropical countries the manufacture of guava jelly forms quite an important industry. When well made, it is deep wine color, clear, of very firm consistency, and retains something of the peculiar musky flavor which characterizes the fruit, and which gives guava jelly an individuality which is its greatest asset. In Brazil a thick jam, known as goiabada, is made from the fruit and sold in large quantities throughout the country. A similar product is manufactured in the West Indies and Florida under the name of guava cheese.

The plant is cultivated to a limited extent in southern California, where it is frequently listed under the name of lemon guava. It is too tender for the colder sections of the state. In Florida it is not only cultivated in gardens, but is found in a semi-naturalized condition in some sections and has become a pest. The same is true in many other regions; the plant grows so readily from seed that it is sometimes difficult to prevent its spreading to places where it is not desired when the seeds are scattered by birds or other agencies.

The Cattley or strawberry guava, *P. Cattleianum*, Fig. 1769, is also a well-known fruit in this country. In California it is widely cultivated because of its superior hardiness, withstanding temperatures as low as 22° F. without injury. It does not grow to such large size as *P. Guajava*, but under favorable conditions forms an arborescent shrub 15 to 20 feet in height. Unlike *P. Guajava*, its leaves are thick, leathery, and somewhat glossy, in size rarely over 2½ inches in length and in form obovate-elliptical. The fruit, which is usually produced in great abundance, is broadly pyriform to spherical, 1 to 1½ inches in diameter. The skin is deep purplish maroon, the flesh translucent yellowish white, very soft and melting in texture. The seeds are rather numerous, irregularly oval in form. The flavor lacks the pungency of *P. Guajava*, and a resemblance, real or imagined, to that of the strawberry has suggested the common name of "strawberry guava." Jelly made from this fruit, while lacking the pronounced flavor of that made from *P. Guajava*, is nevertheless highly esteemed in California, most of the fruit being utilized for jelly-making.

While rather slow in growth, the plant frequently begins to bear fruit the second or third year from the seed. A horticultural form of this species, *P. Cattleianum lucidum*, generally listed by the trade as *P. lucidum*, is grown both in Florida and California, though not so extensively as *P. Cattleianum* itself. The chief difference between this form and the type lies in the color of the fruit, which in place of maroon is deep sulfur-yellow. The flavor, if anything, is a little milder and less pungent. It is a meritorious form, worthy of wider cultivation.

The "pineapple guava," of California, is *Feijoa Sellowiana*, a South American myrtaceous fruit not properly called a guava, perhaps, but so closely resembling some of the guavas in growth and fruit as to suggest this name. See *Feijoa*. Several other species of Psidium are grown in this country to a limited extent, some of them having been recently introduced. Tropical America is rich in species of Psidium, Brazil alone possessing a large number of economic value. Most of these are still in the wild state and capable of vast improvement by selection and breeding.

The culture of the guavas presents few difficulties. Nearly all species succeed on a variety of soils, requiring only that good drainage be provided. While propagation is nearly always by seed, some vegetative method must be used to perpetuate desirable varieties. This is especially important with *P. Guajava*, in which there is more variation than in *P. Cattleianum*, and desirable forms do not come true from seed. Grafting has been successfully performed but never widely practised. In California, budding has been quite successful, with large stocks an inch or more in diameter and square or oblong patch buds about 1½ inches in length. This method, however, does not seem very suitable for commercial use. Shield-budding has been successful in a few instances, the operation being performed as with citrus, and it is this method which probably offers the greatest advantages. Propagation by cuttings is also possible, when half-ripened wood is used and bottom heat is available. All these methods have been practised to a very limited extent, seed-propagation being practically the only method used in most tropical countries. Seeds retain their vitality for some time, but should be planted as fresh as possible, using a light sandy loam and taking care to avoid over-watering when the young plants appear. When the second leaves have formed, the plants should be potted off and carried along in pots until they are transplanted into permanent positions, since they are somewhat difficult to transplant from the open ground. Planting should be done in late spring.

In California *P. Guajava* frequently suffers from the attacks of the black scale (*Saissetia oleæ*), which must be kept in check by fumigation or spraying. In other countries this plant seems remarkably free from insect pests or fungous diseases, and this is true also of the Cattley guava. The fruits are sometimes injured by the Mediterranean fruit-fly, and a scab has been observed in Brazil which affects them prejudicially. As a rule, however, the plants require little attention.

F. W. Popenoe.

GUAZÙMA (name of Mexican origin). *Sterculiàceæ*. A few Trop. American trees, allied to Theobroma, with small white, pink or yellow fls. in short-peduncled, axillary cymes. Calyx mostly 3-parted; petals 5, 2-parted; stamen-cup about 10-lobed, the lobes alternating with petals and bearing 2–3 fertile anthers, the staminodia 3-angled; style 5-parted: fr. a 5-valved nut the size of a filbert: lvs. 2-ranked, serrate: fls. small. Theobroma has a berry-like fr., entire lvs., fascicled or solitary fls., and a different staminal column. **G. ulmifòlia**, Lam., the "guacima" of Mex., is offered in Calif. It becomes a large tree: branchlets powdery: lvs. ovate to oblong-lanceolate, somewhat pointed, oblique at base, powdery beneath when young but becoming glabrous: nut nearly globular, with 5 furrows. Said to yield medicinal preparations. *G. tomentòsa*,, Kunth, is a small tree in W. Indies, apparently not cult. here.

L. H. B.

GUETTÁRDA (J. E. Guettard, 1715–1786, physician, mineralogist and botanist in France). *Rubiàceæ*. Forty to fifty tropical and subtropical shrubs of both the eastern and western hemispheres, chiefly the latter, two of which are offered for ornament in southern California.

Leaves opposite or verticillate, ovate or oblong, petiolate or nearly sessile: fls. in axillary more or less forked cymes, sometimes polygamo-dicœcious, 4–9-merous; calyx continued beyond ovary into a cup-shaped or bell-shaped rim; corolla salverform, with long tube and rounded or oblong segms.; stamens 4–9, inserted in the tube or throat, not exserted; ovary 4–9-celled: fr. a thin-fleshed globular or obtusely angled drupe.

uruguénsis, Cham. & Schlecht. Lvs. 2 in. long, half as wide, elliptic-oblong, somewhat pilose above and more or less tomentose beneath; stipules lanceolate-triangular, caducous: corolla-tube ¼in. or less long, the 5 lobes roundish; calyx-limb very short: fr. an oblong 3–4-seeded drupe.—Cent. Brazil, Uruguay, Argentina; a small tree, with sericeous corolla, and fr. the size of a cherry which is said to be edible.

speciòsa, Linn. A littoral evergreen tree: lvs. broadly ovate with an obtuse or cordate base, acute at apex, pubescent beneath, 5–10 in. long: fls. polygamous, white, in long-peduncled cymes that usually arise in the axils of fallen lvs.; calyx villous; corolla pubescent, 1½ in. or less long and the limb (with obovate segms.) 1 in. across: fr. orange, nearly globular, obscurely lobed or angled, said to be edible. Tropics in eastern hemisphere. B.R. 1393. L. H. B.

GUEVÎNA: *Gevuina.*

GUICHENÒTIA (Antoine Guichenot, French gardener, according to some; from Guichen Bay, New Holland, according to others). *Sterculiàceæ*. A few tomentose shrubs in extra-tropical Austral., little known in cult. as greenhouse shrubs. Lvs. narrow and entire, revolute, with leafy stipules: fls. small, in simple racemes opposite the lvs.; petals 5, small and scale-like; stamens 5; ovary 5-celled, the style simple: fr. a short 5-valved caps. *G. ledifòlia*, Gay, has several white fls. in the raceme: lvs. oblong-linear, obtuse: calyx ⅛in. or less long. *G. macrántha*, Turcz., has much larger purplish fls. in racemes of 2 or 3. B.M. 4651. J.F. 3:279. L. H. B.

GUILIÉLMA: *Bactris.*

GUIZÒTIA (after Guizot, the celebrated historian). *Compósitæ*. Annual herbs (of about five species) from tropical Africa, one of which has some economic interest from its oil-producing seeds.

The plants have yellow heads, about 2 in. across, with 8 broad, 3-toothed rays and a leafy outer involucre. Seeds can be secured by the pound from S. Fla., and they are listed among miscellaneous agricultural seeds in a few of the largest European catalogues. The plant is cult. in India for the oil.

abyssínica, Cass. (*G. oleífera*, DC. *Verbesìna sativa*, Roxbg.). Erect, annual, nearly smooth: lvs. opposite, lanceolate, clasping, remotely serrate: heads about ¾in. wide in a dense cyme. B.M. 1017.—Doubtfully in cult. horticulturally in Amer. N. Taylor.†

GUMS AND RESINS. Of the many thousands of vegetable substances falling under the denomination of gums and resins, but a comparatively small number are of such general importance as to warrant mention here. Their economic value depends upon the physical and chemical properties possessed by them and the abundance in which they are produced. A gum, in the ordinary use of the word, is a substance of a more or less sticky nature or which was at one time of a sticky or plastic consistency. The chemist, however, restricts the term gum to certain products having very definite properties, classifying other plant exudations according to their properties and grouping them as resins, gum resins, balsams, and the like. A gum in this restricted sense, is a substance which dissolves or softens in cold water, forming a mucilage, or at least a liquid of gelatinous consistency, and when held in a flame only chars with an odor of burnt sugar. It is insoluble in 60 per cent alcohol, oil of turpentine, benzene or fatty oils. A resin, on the other hand, is a lustrous vegetable substance resembling a gum but which neither dissolves nor softens in cold water and which burns with a bright smoky flame, giving off an aromatic odor. It is more or less soluble in alcohol, oil of turpentine, benzene or warm oils.

Gums are related, chemically, to cellulose and are not secretion products, as was formerly supposed, but are formed directly from the plant tissues by a breaking down of the cells themselves; sometimes this is a perfectly normal process but very often it may be considered pathological and is the result of bacterial action. Humidity appears to be the principal controlling factor in the production of gum. Volatile or essential oils are secreted by the cells of many plants of widely divergent relationships and are often characteristic of certain families, like those to which belong the mints and the pines. The resins are oxidation products derived from certain of the volatile oils and thus may indirectly be considered products of secretion. Some plants yield only gum, others only resin, while others again may yield both, in which case the gum and resin may come from different parts of the same plant or may be exuded as an emulsion or mixture. In many plants the resins occur dissolved in volatile oil and though exuded in a liquid state soon become solid through the evaporation of more or less of the volatile oil. Some resins contain aromatic acids and others consist of certain liquid organic compounds of these acids in which is dissolved a solid resin; such products are called balsams. The camphors constitute another group of oxidation products derived from the volatile oils.

Uses of gums and resins.

Soluble gums, the most typical of which is gum arabic, are used for a great number of purposes in the arts; the varieties having the least color, highest adhesive power and viscosity being the most valuable. They find application in confectionery and pharmacy, in sizing and finishing textile fabrics and paper, in calico printing and dyeing, and in the manufacture of fine water-colors, ink, mucilage, and so on. The gums which are more or less insoluble in water, but which swell with it to form a mucilage, as for example tragacanth, are used as thickening agents in calico-printing and in pharmacy, and for pastes, pills and colored crayons.

Resins are applied to a great variety of industrial purposes but probably the most important of these is the manufacture of varnishes and lacquers. For this purpose they may be roughly divided into two classes: (1) those which after melting can be combined with linseed oil and turpentine to form an "oil varnish," and (2) those which dissolve more or less in alcohol, oil of turpentine or other volatile solvents to form "spirit varnishes." The important resins of the first class are amber and the copals; while those of the second class include rosin or colophony, benzoin, dammar, sandarac, mastic and elemi. Aside from varnish-making, certain resins are employed in medicine and pharmacy, for incense, and in the manufacture of soap, and the like.

The gums and resins of greatest economic importance.

The following list of the plant exudations which are of the greatest economic importance and which comprises one or more typical examples of each of the groups already mentioned may be arranged as follows:

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True gums	Gum arabic Tragacanth	Gum-resins	Gamboge Myrrh Olibanum Galbanum
True resins	Amber Copal Dammar Sandarac Mastic Rosin	Oleo-resins	Turpentine Canada balsam Copaiba Elemi
Balsams	Balsam Peru Storax	Camphors	Camphor (Common or Laurel Camphor) Menthol

Gum arabic.—The name still generally applied to the most important gum produced in northern Africa and which has been an article of commerce since the first century of the Christian era. It was shipped from Egypt to Arabia and then thence to Europe and was therefore called "gum arabic." At present the gum is usually known as "Sudan," "Kordofan" or "Senegal" gum, depending upon the region from whence it is shipped to market. The best gum is produced by the gray-barked acacia tree, *Acacia Senegal*, and is collected both from wild or unowned trees and from gardens of acacia trees which are private property. In the gardens the gum is obtained by making incisions in the principal branches of the trees while from the wild trees the naturally exuded gum is collected. Inferior varieties are collected from *Acacia Seyal*, chiefly from the forests of the Blue Nile, and from *Acacia arabica*, *A. stenocarpa* and *A. albida* in Senegal. The gum is cleaned from pieces of bark and other debris before leaving Africa but the bulk of the product is exported without grading and is sorted in Europe, principally at Trieste and Bordeaux.

Tragacanth.—The most important of the so-called insoluble gums, and the only one regularly found in commerce, is obtained from several species of small shrubs of the genus Astragalus, found in Asia Minor, Syria, Armenia, Kurdistan and Persia. It is produced chiefly by the following species: *Astragalus adscendens*, *A. gummifer*, *A. pycnocladus*, *A. kurdicus* and *A. stromatodes*. In order to obtain the greatest quantity of gum, the shrubs are stripped of their leaves in July or August and short incisions or slits are made in the trunks. The gum flows out, forming flat ribbon-like or vermiform pieces depending upon the shape and size of the incision, and is dry enough for gathering in three or four days. Smyrna is an important market for gum tragacanth and it is there sorted into various qualities for the European market.

Amber.—A fossil resin found principally on the shores of the Baltic Sea. The larger and finer pieces are used for jewelry, beads, trinkets, mouthpieces for pipes and cigar-holders, while the smaller pieces and the waste from carving or turning are used for varnish.

Copals.—The term "copal" is now used commercially to designate a group of widely distributed hard resins of high melting point having the common property of being capable of being used for the manufacture of oil varnishes. Aside from amber, Zanzibar, or true copal was the first resin used for this purpose, hence arose the custom of terming as "copal," each new resin which was discovered to be useful for this purpose and distinguishing it from others by prefixing its port of shipment or other geographical name. Copals are obtained in round tears, nodules or flat pieces of varying degrees of hardness, either from living trees (recent or raw copals) or dug from the earth at spots, occupied centuries before by trees long since disappeared (fossil or ripe copals). The most important are yielded by the following plants: Zanzibar copal, *Hymenæa Horneman-niana;* Sierra Leone copal, *Copaifera Guibourtiana;* Gold Coast or Accra copal, *Cyanothyrsus Ogea;* Niger copal, *Daniella oblonga;* Kauri copal, *Agathis (Dammara) australis;* Manila or East Indian copal, *Agathis (Dammara) orientalis;* West Indian or Demerara copal, *Hymenæa Courbaril.*

Dammar.—Dammar is the Malay term for all gums and resins which exude from trees and solidify upon exposure to the air, but as used commercially it designates a group of varnish resins obtained from Indian or East Indian trees belonging to the *Dipterocarpaceæ* and *Burseraceæ* and thus does not include the resins from the genus *Agathis* (or *Dammara,*) which are known as copals. Indian dammar, *Shorea robusta;* white dammar, *Vateria indica;* black dammar, *Canarium strictum;* rock dammar, *Hopea odorata.*

Sandarac.—The hard brittle resins produced by several species of coniferous trees in North Africa and Australia. Mogadore sandarac, yielded by a small cypress, *Thuya articulata*, common on the southern slopes of the Atlas Mountains, is shipped principally from the port of Mogadore, Morocco. Australian sandarac is the product of several species of cypress pines, especially the Murray pine, *Callitris verrucosa* and the red or black pine, *Callitris calcarata.*

Mastic.—A soft yellow resin obtained in brittle, yellowish, glassy, rounded drops from *Pistacia lentiscus*, a small tree indigenous to Asia Minor and the Greek Archipelago but cultivated on the island of Chios. Used for varnishing paintings, for incense and as a tooth cement.

Common rosin or colophony.—This is the solid residue obtained as a by-product in the distillation of oil of turpentine from crude turpentine. For a list of the most important sources, see *Turpentine*, below. Rosin is used for cheap furniture varnishes, in the sizing of paper, as a flux for solder, as a coating for the inside of casks, and in the manufacture of laundry-soap. It is the source for rosin-oil and rosin-spirit, which are produced by the destructive distillation of rosin. The first is used in the production of lubricants, printing inks and paints, while the second is a substitute for oil of turpentine.

Gamboge.—A hard brittle yellow gum-resin, composed of a variable mixture of gum and resin, and produced by several species of Garcinia, especially *G. Hanburyi* of Siam and Indo-China and *G. Morella* of India and Ceylon. It is used to color golden lacquers, as a water-color pigment and in medicine as a drastic purgative.

Myrrh.—A fragrant gum-resin obtained in Arabia and northeastern Africa from a burseraceous tree *Balsamodendron Myrrha.* It is used in medicine and for dental preparations.

Olibanum or frankincense.—A fragrant gum-resin obtained from the stem of several species of Boswellia, especially *B. Carterii*, native to northeastern Africa and the southern coast of Arabia. Its principal use is for the incense used in the Roman Catholic and Greek churches.

Galbanum.—A strong-smelling, yellowish brown gum-resin exuded from the stem of certain species of Ferula, especially *F. galbaniflua* and *F. rubricaulis*, natives of Persia. It is mentioned by the earliest writers on medicine and was an ingredient of the incense used in the worship of the ancient Israelites. It is now used only to a small extent in medicine.

Turpentine.—The crude oleo-resin obtained by tapping any one of several species of coniferous trees native to North America, Europe and northern Asia. The most important varieties are yielded by the following species: American turpentine from the long-leaf pine, *Pinus palustris*, and the Cuban pine, *Pinus heterophylla;* French turpentine from the maritime or cluster pine, *Pinus maritima;* Russian turpentine from the Scotch or Swedish pine, *Pinus sylvestris;* and Indian turpentine from the Indian blue pine, *Pinus excelsa*, the Himalayan long-leaf pine, *Pinus longifolia* and the Burma pine, *Pinus khasya.* From these oleo-resins there is distilled oil of turpentine, leaving behind rosin or colophony. Venice turpentine, from the common larch, *Larix europæa*, is about the consistency of clear honey, and is used in fixing colors, enamel painting and firing and in medicine.

Canada balsam.—A thick, yellow, transparent, liquid oleo-resin obtained in the northern United States and Canada from the balsam fir, *Abies balsamea*. On account of its great capacity for refracting light it is used to cement lenses and for mounting objects for the microscope. It is also used in medicine.

Copaiba balsam.—A thick, transparent, brownish, liquid oleo-resin obtained from several species of leguminous trees belonging to the genus Copaifera and native to northern South America. It is used in medicine as an antiseptic and stimulant.

Elemi.—More or less soft resins yielded by burseraceous trees belonging to the genera Protium and Canarium. Manila elemi from *Canarium luzonicum* is a fragrant resin used for toughening varnishes.

Balsam Peru.—A dark brown molasses-like liquid balsam obtained in Salvador and Guatemala from the stem of a leguminous tree, *Myroxylon Pereiræ*. It is used in medicine, perfumery and chocolate manufacture.

Styrax or storax.—A thick, grayish, sticky, liquid balsam obtained in Asia Minor from the oriental sweet gum, *Liquidambar orientalis*. It is used in perfumery, pharmacy and in medicine.

Common or laurel camphor.—A white, crystalline, pungent substance obtained by distilling with steam the twigs and chips of the camphor tree, *Cinnamomum Camphora*, native to China and Japan and cultivated in the southern United States. It is used in medicine and for the manufacture of celluloid, lacquers and smokeless powders.

Menthol or peppermint camphor.—The principal constituent of oil of peppermint, the essential oil of *Mentha piperita*, from which it can be crystallized by chilling. It resembles common camphor but has a strong peppermint odor. Used in medicine and perfumery.

FREDERICK L. LEWTON.

GUM-TREE: *Eucalyptus* and *Acacia;* also *Liquidambar.*

GUNNÈRA (J. Ernst Gunner, 1718–1773, was a Swedish bishop and botanist, and wrote a local flora). *Haloragidàceæ*. Perennial herbs, some of them big-leaved and used for subtropical effects; others small and useful for bogs and rockeries.

The family Haloragidaceæ comprises above 100 widely scattered and heterogeneous species in 8 genera. In the northeastern states are the aquatic genera, Proserpinaca, Hippuris, Myriophyllum. These comprise small and mostly inconspicuous water- or bog-plants. In the Australian region are the endemic genera Loudonia and Meionectes; and there remain Serpicula, Gunnera, and Haloragis, with very wide and disjointed distributions. Gunnera has 25 or more known species in S. Afr., Abyssinia, Java, Tasmania, New Zeal., Hawaii and S. Amer. In general appearance the gunneras are wholly unlike our native haloragaceous plants. The lvs. are radical, ovate or orbicular, in certain species gigantic: fls. perfect or rarely imperfect monœcious or polygamous, small, in simple or branched spikes or panicles, often packed on a great cob-like spike; petals 2–3, or none; calyx none, or with 2–3 lobes; stamens 1 or 2 or 3; ovary 1-loculed, bearing 2 filiform styles: fr. a drupe: plant rhizomatous.

Gunneras are striking herbs, and with protection the two first species may be grown even in some of our northern states. These two are amongst the noblest of lawn foliage plants. To produce satisfactory effects, rich moist ground is indispensable. The plants must never suffer for want of water. Exposure to sun is

1770. Gunnera manicata.

advisable, but they should be sheltered from severe winds, else the leaves will be damaged. Ample winter protection should be provided. A liberal covering of leaves or litter, held in place by brush or branches, will generally keep them from harm. Apply the covering in December and remove early in spring. Propagate by division. Seeds are also employed, and they can usually be secured.

A. *Lvs. very large and striking.*

manicàta, Lind. Fig. 1770. St. thick and very short, the titanic crown of lvs. rising from the ground: petioles often as tall as a man, prickly: blades becoming 5–10 ft. across, orbicular in general outline, variously lobed, crenate, furrowed and channeled along the great veins: fls. green: spikes dense and tapering, often more than 1 ft. diam. and 3–4 ft. tall. S. Brazil. I.H. 31:531. Gn. 45, p. 21; 50, p. 455; 54, p. 385; 59, p. 327; 63, p. 127; 70, p. 179; 74, p. 451. G.C. III. 14:589; 29, suppl. Jan. 12. G.M. 54:101, 647. G.F. 8:55.—The crown of lvs. sometimes measures 25–35 ft. across, making a magnificent plant. This is the better species.

chilénsis, Lam. (*G. scàbra,* Ruiz & Pav.). Not so robust, the lvs. smaller and less spiny, and the fl.-spikes less tall: fls. reddish. R.H. 1862, p. 310; 1894, p. 397.

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Gn. 49, p. 151. G.C. II. 26:425; III. 8:665. G. 18:693; 21:661. G.W.5:367, 571; 12:413.—Thrives in drier soil. Var. **màjor**, Hort., is a very strong-growing form.

AA. *Lvs. of ordinary or even small size.*

arenària, Cheesem. Prostrate and creeping plant making extensive patches in damp sandy land in New Zeal., the rhizome stout and clothed with bases of old foliage: lvs. 2½ in. or less long, thick, only slightly hairy, the blade less than 1 in. and broadly ovate or oblong, crenate or somewhat lobed: male peduncles usually longer than lvs., and female much shorter at flowering time; female fls. densely crowded into a short oblong spike: drupes very small, fleshy, yellowish red.

dentàta, Kirk. More slender, forming extensive patches in wet subalpine places in New Zeal.: lvs. many and tufted, prominently hairy, the blade 1 in. or less long and varying from ovate to oblong and elliptic-lanceolate, coarsely dentate: male spikes about equaling the lvs., the female short and hidden at the base of the lvs., but the spikes in fr. sometimes surpassing the lvs.: drupes minute (1/16in. long).

magellánica, Lam. A very small species with dark green lvs.: stoloniferous: lvs. orbicular-reniform, crenate, 2½ in. or less broad: male scape surpassing the lvs., female shorter: fls. apetalous, the male pedicelled, the female sessile. Chile south, and Falkland Isls.

G. brephogàa, Lind. & André. A large species: lvs. tall-petiolate, the limb peltate, concave, orbicular-reniform, rather shallowly 7–9-lobed and the lobes again somewhat lobed or angled, the margin with many small acute inflexed teeth and black-purple: female fls. in a lax spike-like panicle, on a purplish scape. Colombia. I.H. 19:111.—*G. mínima*, Hort.=G. magellanica (?).—*G. perpénsa*, Linn. Lvs. long-petioled (12–18 in.), orbicular-reniform, cordate at base, 6–12 in. across, uniformly and closely crenate-toothed: scape surpassing the lvs., becoming 2–3 ft. high; fls. monœcious, the males in the upper part of the slender spikes. S. Afr. in moist places. B.M. 2376.

L. H. B.

GURÀNIA (Anagram of Anguria). *Cucurbitàceæ.* Tall climbers, perennial herbs or shrubs, with simple tendrils: lvs. entire, lobed, or 3–5-foliolate: fls. dicœcious or rarely monœcious, small, bractless, the petals pale yellow; male fls. in long-peduncled clusters, the calyx-tube cylindrical or ventricose and the limb 5-parted, the corolla 5-parted into linear or triangular papillose thickened segms., the stamens 2 and free; female fls. solitary on fascicled or capitate on the top of the peduncle, staminodia none, ovary oblong and bearing a bifid style: fr. oblong, terete, many-seeded, the seeds ovate and compressed. There are about 50 guranias in the American tropics, one of which, *G. malacophýlla*, Rodr. (*G. eriántha*, André, not Cogn.), has recently been mentioned in horticultural literature abroad. This is a strong villous climber with simple broadly ovate sometimes 3- to 5-lobed lvs. 4–8 in. long: male fls. reddish, in a globose head on a peduncle 6–16 in. long; petals linear-subulate, pubescent; female fls. not described. Upper Amazon. B.M. 8085. R.H. 1904:388.

L. H. B.

GUSTÀVIA (Gustavus III, King of Sweden). *Lecythidàceæ.* Trees and shrubs of the American tropics with large showy fls., of which **G. speciòsa,** HBK., is offered in S. Calif. It is a thick-lvd. tree with 6-petaled white fls., suitable for planting in the open. For fuller account, see *Japarandiba.*

GUTHNÍCKIA. Two plants now referred to Achimenes, one of which, *A. foliosa*, is perhaps sometimes cult. (See Vol. I, p. 208.)

GUTIERRÈZIA (personal name). *Compósitæ.* Herbs or subshrubs, often resinous, mostly western North American, rarely planted in borders.

Much branched from the base, and have narrow alternate entire lvs. and clusters of small yellow heads with flat receptacles and hairy achenes.—About 18 species. Easily cult. in Calif.; doubtfully hardy on Atlantic coast north of Washington.

Euthàmiæ, Torr. & Gray. More or less woody at base, seldom to 1½ ft. high: lvs. linear, crowded: involucre turbinate, 2 lines long; rays and disk-fls. each 3–9: achenes silky-pubescent; pappus of about 9 chaffy scales. W. N. Amer.

N. TAYLOR.†

GUZMÀNIA (A. Guzmann, Spanish naturalist). *Bromeliàceæ.* Includes *Caraguàta* and *Massángea.* Tropical American bromeliads, of which several are fairly well known ornamental glasshouse subjects.

They closely resemble the erect-growing tillandsias, but differ in technical characters: fls. in a simple spike-like terminal cluster, tubular, the outer segms. or calyx oblong and obtuse, the inner or petals shorter than the tube; anthers inserted on the throat of the tube, and united by their edges around the style.—About 75 species. Grown in the warmhouse, along with Billbergia and Tillandsia, which see for culture. Closely allied to Æchmea. Many species are cult. in fanciers' collections in the Old World. For *G. picta*, see *Nidularium.* For *G. Legrelliana*, see *Hohenbergia. G. rosea*, a name which has appeared in the American trade, is probably an Æchmea.

A. *Calyx corolla-like, exceeding the petals.*

musàica, Mez. Lvs. strongly decurved, beautifully and densely marked with undulating, interrupted, irregular brown lines: infl. 3–4 in. long, on a short peduncle, the bracts golden, striped with rose; fls. 1⅔–2 in. long. Colombia. B.M. 6675. I.H. 24:268.

AA. *Calyx not corolla-like, shorter than petals.*

B. *Corolla (or segms.) purple or red.*

lingulàta, Mez (*Caraguàta lingulàta*, Lindl. *C. spléndens*, Bouché. *C. lingulàta spléndens*, Hort.). Epiphyte: lvs. many, lanceolate or ensiform, 1½ ft. long, remotely toothed: spike becoming drooping, showily red-bracted; expanded fl. about as long as the long-pointed bracts, the tube yellowish and the limb blue-purple. W. Indies, Cent. Amer., and S. Amer. B.R. 1068. F.S. 11:1091.—Handsome. Var. **cardinàlis,** André (*Caraguàta cardinàlis*, André). Bright scarlet: very showy. Colombia. I.H. 27:374. R.H. 1883:12.

BB. *Corolla (or segms.) white.*

trícolor, Ruiz & Pav. (*G. fràgrans*, Hort., at least in part. *G. grándis*, Hort., in part. *G. maculàta*, Hort., in part. *G. monostàchya*, Rusby). Lvs. several to many, broad and more or less recurved, entire on the edges, usually shorter than the stout, erect spike: lower bracts green streaked with black, upper ones red-tinged: corolla white. W. Indies, Cent. Amer., S. Amer. L.B.C. 5:462. F.S. 9:918. B.M. 5220. Var. **variegàta,** Hort. Lvs. striped with white. S. Fla.—Interesting because of its combination of green, red and white. Some, at least, of the horticultural plants which pass as *G. fragrans* belong to *Æchmea eburnea*, Baker (*Canistrum Lindenii*, Mez. *Nidularium Lindenii*, Regel). This species is further mentioned under *Nidularium.*

Devansayàna, Morr. (*Caraguàta Devansayàna*, Morr.). Lvs. about 20, narrow linear or ensiform, brown-striped on the back: fls. white, in a dense, oblong spike, the scarlet bracts oval. Ecuador.

BBB. *Corolla (or segms.) yellow.*

Melinònis, Regel (*Caraguàta Melinònis*, Morr.). Lvs. strap-shaped, green above and brown-tinted beneath: fls. yellow, subtended by oblong red bracts. French Guiana.

GEORGE V. NASH.†

GYMNÓCLADUS (from Greek *naked*, plus a branch, which refers to the stout branches with few branchlets). *Leguminòsæ.* Trees, useful for bold planting.

Flowers dicœcious or polygamous, regular, not papilionaceous; calyx tubular, 5-cleft; petals 5, oblong,

perigynous, resembling the sepals, or slightly larger and paler; stamens 10; filaments pubescent, distinct, short, perigynous; pistil 1; ovary superior, simple, 1-celled; placenta parietal; ovules numerous; style slender: fr. an oblong (2–10-in. long), thick, flat, curved, dark brown legume; seeds lenticular, about 1 in. broad.—The genus contains 2 species, one American, the other E. Asian. The American species, the Kentucky coffee tree, is now frequently planted for ornamental purposes. Its ascending branches, coarse twigs and pods give it a peculiar sturdy aspect, heightened in summer by the immense compound lvs. Prop. by seeds and cuttings. Foliage appears in late spring.

dioica, Koch (*G. canadénsis,* Lam.). KENTUCKY COFFEE TREE. Fig. 1771. Tree up to 100 ft. high, unarmed: lvs. alternate, unequally twice-pinnate, 1½–3 ft. long; lfts. ovate or oval, acuminate, stalked, entire, glabrous, 1–3 in. long: fls. ½in. long, greenish white, in

1771. Gymnocladus dioica. (×⅛)

large panicles, which terminate the branches of the same season: pods persistent through the winter. Rich woods, Cent. N. Y., and Pa. to Minn., Neb., Okla., and Tenn. S. S. 3:123, 124. R.H. 1897, p. 491. B.B 2:261. G. 6:215.—Seeds used for coffee west of the Alleghanies before and during the Revolutionary war.

G. chinénsis, Baill., with smaller more numerous lfts. and much thicker pods, is not cult.

K. M. WIEGAND.

GYMNOGRÁMMA. Ferns that belong in several genera, to which they are here referred. The ferns described under Gymnogramma in previous editions are distributed in the present edition as follows:

For *Gymnogramma hispida,* see *Gymnopteris;* for *G. triangularis, G. chrysophylla, G. sulphurea, G. decomposita, G. calomelanos, G. peruviana, G. tatarica, G. pulchella,* see *Ceropteris;* for *G. aurea,* see *Ceropteris argentea;* for *G. schizophylla,* see *Anogramma.*

R. C. BENEDICT.

GYMNOLÒMIA (*naked border,* because the pappus is minute or none). *Compósitæ.* About 20 yellow-fld. herbs or woody plants from Ga. to Mex., much like small-fld. helianthus. Lvs. alternate or opposite on erect branching sts.: fl.-heads on peduncles terminating the branches; involucre hemispherical or bell-shaped, with narrow bracts in 2 or 3 series; receptacle chaffy, more or less conical; ray-fls. pistillate and sterile; disk-fls. perfect, producing 4-angled achenes. Allied to Viguiera, and distinguished by the obsolete or wanting pappus. Probably none of the species is in cult. *G. Pórteri,* Gray, occurs on Stone Mt., Ga.: 1–2 ft. high, slender, with 5–8 oval or obovate rays ½in. or more long, deep orange-yellow. The other species are of the Texano-Mex. region.

L. H. B.

GYMNOPÉTALUM (Greek, *naked petal*). *Cucurbitàceæ.* Six species of tendril-bearing vines of tropical Asia and Java, of which one, *G. cochinchinense,* is cultivated chiefly for its ornamental gourds.

This species is a tender perennial plant, and is said to have small white fls. borne in late summer and autumn, as advertised in the seed catalogues, under the name of *Scotanthus tubiflorus.* Scotanthus was formerly thought to be a closely allied genus, differing in the staminate fls. possessing bracts and 3 bristle-like rudiments of an ovary, while the staminate fls. of Gymnopetalum, by the old definition, have no bracts or minute ones, and but 1 rudiment of an ovary. Coigneaux includes Scotanthus in Gymnopetalum.

cochinchinénse, Kurz (*Scotánthus tubiflòrus,* Naudin). Musk-scented: st. much-branched, slender, grooved, creeping or climbing, 5–7½ ft. long: tendrils filiform, elongated, simple: lvs. about 1½–2½ in. long, 1–2 in. wide: fls. monœcious, white; calyx-teeth long linear-awl-shaped; calyx shortly villous, not tomentose: lvs. ovate, angled or slightly lobed: fr. bright red, ovoid, 10-ribbed, rather acute at the base, produced at the apex into a long point which withers and remains, 2 in. long, more than 1 in. thick.

L. H. B.

GYMNÓPSIS: *Sclerocarpus.*

GYMNÓPTERIS (Greek, *naked fern*). *Polypodiàceæ.* A group of small tropical ferns with once-pinnate hairy lvs. with the sporangia forming long lines along the veins without indusia; the lf.-margins not rolled over as in Cheilanthes, and to which the genus is related.

hispida, Underw. (*Gymnográmma hispida,* Mett.). A low plant, 5–8 in. high, with pentagonal, palmate lvs. 1 in. or more either way, densely covered on both sides, but especially below, with strigose hairs. Has been incorrectly referred to *Gymnogramma Ehrenbergiana.* Texas, Ariz., Mex.—Hardy.

R. C. BENEDICT.

GYMNOSPÒRIA (*gymnos,* naked and *sporos,* seed; the seed being sometimes without aril). *Celastràceæ.* A genus of about 60 species widely distributed through Trop. and Subtrop. Afr., Asia and Austral., S. Eu. and Subtrop. S. Amer. Closely related to Celastrus, but easily distinguished by their habit, being rigid, often spiny shrubs or small trees with coriaceous rather small lvs. and perfect small whitish fls. in axillary cymes followed by small capsular dehiscent frs.; seeds with or without aril. None of the species is hardy N.; *G. variabilis* being probably the hardiest. They are of little or no ornamental value and only occasionally and rarely cult. in botanical collections. Except *G. serrata* which is cult. in S. Calif., and recommended as a suitable shrub for evergreen hedges. Prop. by seeds and probably by cuttings.

serràta, Loes. (*Celástrus serràtus,* Hochst.). Evergreen shrub; the branches with slender spines or unarmed, puberulous or nearly glabrous at the extremities: lvs. coriaceous, short-petioled, ovate or elliptic to oblanceolate, obtuse, serrulate, glabrous, reticulate beneath, 1½–3 in. long: cymes small on axillary, forked, puberulous peduncles much shorter than the lvs.: caps. 3-valved, smooth. Abyssinia. **G. buxifòlia,** Szyszylowicz (*Celástrus buxifòlius,* Linn.). Usually spiny, several feet high: lvs. obovate, obtuse, crenately serrate, 1–2 in. long:

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cymes dense, short-peduncled. Afr. B.M. 2070 (as *Celastrus cymosus*) and 2114 (as *C. buxifolius inermis*). **G. variábilis,** Loes. Lvs. oblong to oblong-lanceolate, acute, serrulate, 2–3½ in. long: cymes slender, much shorter than lvs.: caps. ½–¾in. across. Cent. China.

ALFRED REHDER.

GYMNÓSTACHYS (Greek, *naked spike*, the scape being leafless). *Aràceæ*. One interesting tuberous-rooted herb with grass-like radical lvs., from Queensland and New S. Wales, sometimes grown in choice greenhouse collections, *G. dnceps*, R. Br. Scape 1 to nearly 3 feet tall, flattened, slender: spikes 1–3 in. long, slender and curved or drooping, in small clusters near the apex, with a leafy bract subtending each cluster; fls. small and sessile; perianth-segms. 4, obovate and not exceeding the ovary; stamens 4: fr. a berry ⅛ or ¼in. long. L. H. B.

GYMNOSTÀCHYUM (*naked spike*). *Acanthàceæ*. Some of the plants of this name are Fittonias (which see). *G. ceylánicum*, Arn. & Nees, is by Lindau (Engler & Prantl Pflanzenfamilien) referred to Cryptophragmium, becoming *C. ceylanicum*, O. Kuntze, but by Bentham & Hooker is retained in the former genus. It is an erect herb from Ceylon, suitable for growing in the hothouse for its white-marked lvs. and small whitish fls. in clusters: lvs. opposite, oval or obovate, obtuse, somewhat serrate. B.M. 4706. J.F. 4:405. L. H. B.

GYMNÒTHRIX: *Pennisetum*.

GYNANDRÓPSIS (Greek words: the stamens look as if they were borne on the ovary). *Capparidàceæ*. Annual herbs grown out-of-doors.

This genus includes a tender plant with 5–7 lfts., and fls. resembling the spider flower, or Cleome. It is known to the trade at present as a Cleome, but Gynandropsis is distinguished by having a long torus (or receptacle), which is produced into a slender body (or gynophore) which is elongated at the middle, and bears the pistil to which the filaments are united. Cleome has a short torus, which often has an appendix on the back: stamens about 6 in Gynandropsis: in Cleome 4–6, often 10: lfts. 3–7: fls. white or purplish; sepals deciduous; petals entire or crenulate, obovate, with a slender claw: fr. a silique, usually inclosed within the calyx; seeds kidney-shaped or orbicular, compressed, with a wrinkled or tubercled coat.—The species of Gynandropsis are perhaps a dozen, in the warmer parts of the world. Pedicellaria is an older name for the genus, but it is not accepted by the "nomina conservanda" of the Vienna code. For cult., see *Cleome*.

speciòsa, DC. (*Cleòme speciòsa*, HBK.). Stiff annual, or perhaps a perennial, usually about 2 ft. and rather velvety toward the top: lfts. 5–7, subserrulate, oblong, acuminate: fls. violet, showy. Mex.

WILHELM MILLER.
N. TAYLOR.†

GYNÈRIUM (Greek, *gune*, woman, and *erion*, wool). *Gramínæ*. Very large perennial grasses with broad, sword-like blades and plume-like dicœcious inflorescence.

Spikelets 2-fld., the florets equal, the rachilla not produced beyond the upper floret; glumes of staminate spikelets equal, of the pistillate spikelets unequal, the upper twice as long as the lower; culms perennial, with extensively creeping rhizomes, the plants growing gregariously in large masses or areas in their native habitat: lvs. rather evenly distributed along the sts., the sheaths about equal, the blades as much as 3 in. wide.—One species in Trop. Amer. Cortaderia of Stapf differs in the 3–6-fld. spikelets, the upper florets more or less reduced, in the equal glumes in both sexes, in the biennial culms with only very short rhizomes, the plants thus growing in large tussocks; in the lvs., scarcely ½in. wide, being crowded at the base of the plant, the sheaths increasing in length from base upward. The difference in appearance between the staminate and pistillate plumes is much more marked in Gynerium than in Cortaderia.

saccharoìdes, Humb. & Bonpl. UVA-GRASS. Culms perennial, as much as 40 ft. high: on the sterile shoots the lvs. are aggregated, fan-like at the summit; on the fertile sts. they are scattered along the middle, the basal and upper portions being naked: plume white or tawny. B.M. 7352.—Cult. for ornament, the plumes resembling those of pampas grass. Not hardy outside the tropics. For pampas grasses see *Cortaderia* and *Pampas-Grass*.

A. S. HITCHCOCK.

GYNÓPOGON (Greek, *bearded stigma*). *Apocynàceæ*. Syn. *Alýxia*. Interesting tropical woody plants, worth cultivating under glass.

The genus was established in 1776 by Forster, based upon *G. stellatus* of Tahiti, and is now known to include at least 50 species distributed in the islands of the Pacific, Madagascar, Austral. and Trop. Asia. Evergreen trees or shrubs, erect or twining, nearly all of which have the agreeable fragrance of coumarin, with entire, short-petioled, glossy, myrtle-like lvs., usually in whorls of 3 or 4, or sometimes opposite: fls. usually fragrant, axillary or terminal, solitary or in umbellate or spicate cymes; calyx 5- or 4-cleft; corolla salver-shaped, its tube cylindrical, swollen above the middle, or slightly contracted at the throat, without scales, the 5 or 4 lobes sinistrose; anthers subsessile, as many as the lobes of the corolla and alternate with them, inserted on the tube; ovary of 2 distinct carpels united by a single style with a capitate, or oblong stigma often bearing hairs on its upper surface; ovules 4–6 in each carpel in 2 series: fr. generally a single ovoid or oblong drupe, usually moniliform, consisting of 2 or more 1-seeded joints placed end to end, sometimes both carpels maturing in the same fl., when the fr. becomes geminate, as in many other Apocynaceæ; seeds ovoid or oblong, furrowed on the ventral side, remarkable for their ruminate endosperm with erect embryo, in which respect they differ from those of other Apocynaceæ and agree with Annonaceæ. Plants of this genus may be prop. by seeds or cuttings. They are worthy of cult. in the conservatory, on account of their dark green lustrous foliage and their fragrant jasmine-like fls.

olivæfórmis, Safford (*Alýxia olivæfórmis*, Gaud.). MAILE. A straggling or somewhat twining shrub with opposite and ternate lvs., blades ovate to oblong, obtuse or acuminate at both ends, coriaceous glossy, with evanescent veins and margins usually revolute over an intramarginal nerve: peduncles axillary, 3- or 4-fld.; corolla yellowish, salver-shaped, the tube slightly dilated below the contracted throat, puberulous within along the adnate filaments, limb 4- or rarely 5-lobed: drupes often geminate, fleshy black, elliptic-oblong, sometimes curved, acuminate at each end. Hawaiian Isls., in the woods of the lower and middle regions.—This is perhaps the most cherished plant of the Hawaiians, who weave its fragrant glossy foliage into garlands, or leis, with which to adorn their friends, and with its branches decorate their houses and lanais on festive occasions; and they also celebrate its fragrance in their songs. Other allied species are the *laumaile* of Samoa (*Gynopogon bracteolosus*), the *nanago* or *Loduson lahe* of the island of Guam (*Gynopogon Torresianus*), and the *maire* of Tahiti (*Gynopogon stellatus*).

W. E. SAFFORD.

GYNÙRA (name refers to the tailed stigmas). *Compósitæ*. Tropical herbs, sometimes grown under glass for the large showy foliage.

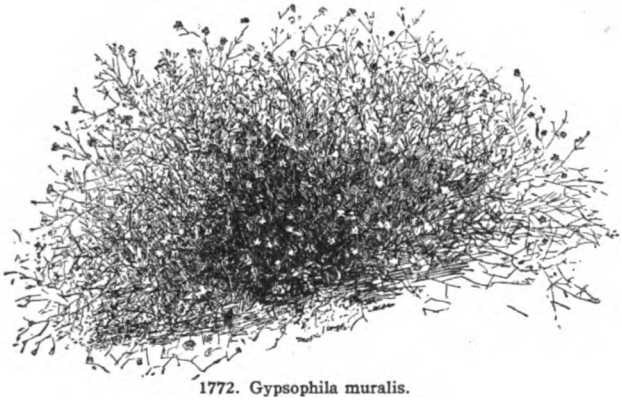
Rarely subshrubby: lvs. alternate, entire or lobed, numerous: heads discoid, the florets commonly all fertile, not very showy; involucre cylindrical or somewhat bell-shaped, the narrow bracts in about 1 series: achene narrow, 5–10-striate, with copious slender

white pappus-bristles. The gynuras are attractive glasshouse herbs, usually requiring a moderately high temperature; prop. by cuttings. Genus allied to Senecio and Cineraria; of about 40 species in Trop. Afr., Asia, to Austral.

aurantiaca, DC. VELVET TREE. Stout and branchy, 2–3 ft., with almost succulent sts. densely clothed with violet or purple hairs: lvs. large and soft, ovate, jagged-toothed, hairy, short-petioled or the upper ones clasping, overlaid with iridescent purple: heads in a terminal cluster, yellow or orange. Java. I.H. 28:436.—A handsome foliage plant. In winter it may be grown in the conservatory or warmhouse, but in the summer it may be bedded out in a warm and protected place. It grows rapidly, and makes a most satisfactory display of colored leafage. It is readily prop. by cuttings in the house, as geraniums are.

Other species, but not known to be in the American trade, are: *G. auriculàta*, Cass. (G. ovalis, DC. Cacalia ovalis, Ker). Only slightly villous: lvs. oval, entire or repand, green both sides: fls. yellow, fragrant. China. B.R. 101.—*G. bicolor*, DC. 2–3 ft., of looser growth than the above, glabrous: lvs. lance-ovate, somewhat downy, short-petioled, deep-toothed or pinnatifid, green above and purple beneath: fls. orange. Moluccas. B.M. 5123.—*G. ovàlis*, DC.=G. auriculata.—*G. sarmentòsa*, DC. Climbing, with purple glabrous sts.: lvs. narrow, ovate to lanceolate, acuminate, petioled, remotely small-toothed, green and purple-ribbed. Warmhouse plant from Malayan Isls. B.M. 7244.

L. H. B.



1772. Gypsophila muralis.

GYPSÓPHILA (*gypsum-loving*, because it likes calcareous soils). *Caryophyllàceæ*. European and Asian herbs, bearing a profusion of small flowers, and useful for mist-like effects in mixed borders and as trimming in bouquets.

Sepals 5, united below, but the calyx naked at the base (not bracted, as in some related genera) 5-nerved; petals 5, clawed, very small, usually white, in some horticultural forms pinkish; stamens 10; styles 2: pod 4-valved: lvs. small, entire, opposite.—Perhaps 75 species. Very branchy or spreading, slender herbs, with scant foliage when in bloom. Of easiest cult. in open, rather dry places. They are desirable for rockwork. They make an excellent effect as filling amongst shrubbery; also good for covering unkempt places with a mass of delicate bloom. Hardy.

A. *Plant annual.*

muràlis, Linn. Fig. 1772. One to 1½ ft., very diffuse and branchy, mostly with shorter joints than *G. elegans*, of finer appearance, the st. rough-hairy near the base, smooth above: lvs. linear, spurry-like: fls. small, rosy, the petals almost recurved, crenate. Eu.—Makes a dense little mound when well grown.

élegans, Bieb. Fig. 1773. One foot, repeatedly forked-branched, glabrous: lvs. sessile, the uppermost linear, the lower oblong or spatulate: fls. white or sometimes (*G. ròsea*, Hort., and in rare wild forms) rosy; petals truncate, almost recurved, 2–5 times as long as the calyx. Caucasus.—Much cult., and handsome.

AA. *Plant perennial.*

B. *Lvs. short, spatulate: plant pubescent.*

cerastioides, D. Don. Low, densely pubescent: lvs. pubescent, the radical ones long-petioled, the others spatulate or obovate, obtuse or nearly so: fls. large (often ¾in. across), white or lilac, pink-veined. Himalayas. B.M. 6699. Gn. 47, p. 422. G. 35:433.—Of creeping habit; excellent for rockwork.

BB. *Lvs. perfoliate.*

perfoliàta, Linn. (*G. scorzonerifòlia*, Hort.). A tall, thick and round-stemmed perennial, usually glabrous, but sometimes hairy near the summit: lvs. perfoliate, 5-nerved: fls. purplish, the sepals only slightly shorter than the petals. Medit. region.

1773. Gypsophila elegans. (Natural size)

BBB. *Lvs. long, not perfoliate: plant glabrous or nearly so.*

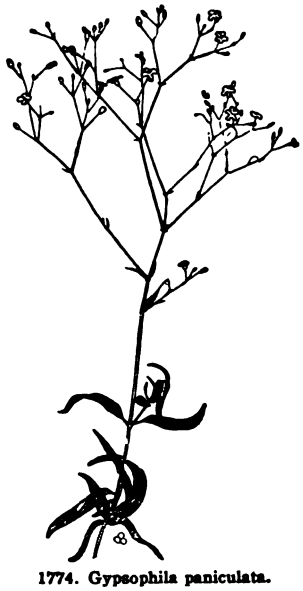
paniculàta, Linn. BABY'S BREATH. Fig. 1774. Diffuse and rather tall-growing (2–3 ft.), forking: lvs. linear-lanceolate, the largest 3 in. long, but becoming smaller toward the infl., sharp-pointed: fls. white, very numerous; pedicels 2–3 times as long as the calyx. Eu. Gn. 68, p. 162.—A very popular plant, especially for use in the trimming of bouquets. A most graceful subject. Sts. stiff and wiry, therefore excellent for cutting. A picture of its use in floral arrangement will be found in A.F. 6:340. Var. **flòre-plèno,** Hort., with double fls. has been advertised, but is little known in Amer. Gn. 60, p. 103. A.F. 19:767. In places where the double form is difficult of cult., it is recommended that it be grafted on roots of *G. paniculata*.

acutifòlia, Fisch. Very like the last, but the plant greener, the lvs. narrower (indistinctly 3-nerved) and the pedicels scarcely longer than the calyx. Caucasus.—*G. paniculata* seems sometimes to be cult. under this name.

Stèvenii, Fisch. (*G. glaùca*, Hort.). Lower than *G. paniculata*, glaucous-green: lvs. linear-lanceolate and carinate, mostly radical: fls. rather larger, white, the panicles smaller than those of *G. paniculata;* petals shorter than the calyx. Caucasus.

rèpens, Linn. (*G. prostràta*, Hort., not of Linn.). Sts. trailing or prostrate, ascending at the ends, not glaucous: lvs. linear, sharp-pointed, glabrous: fls. rather large, white, the petals about twice longer than the sepals and the pedicels usually much longer. Alps and Pyrenees. B.M. 1448.—Best adapted to the rockery, and the mixed border; blooms from midsummer to autumn. Var. **monstròsa,** Hort., is larger but otherwise the same. Var. **ròsea,** Hort., has rose-colored fls. and is frequently sold as *G. prostrata rosea*, also as *G carminea*, Hort., which does not seem to differ.

N. TAYLOR.†



1774. Gypsophila paniculata.

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H

HABENÀRIA (Greek, *a rein* or *strap;* referring to the shape of parts of the flower). *Orchidàceæ*, tribe *Ophrýdeæ*. REIN ORCHIS. Terrestrial leafy herbs, sometimes grown in bog-gardens and naturalized in moist places.

Tubers usually undivided, rarely lobed: fls. in terminal racemes or spikes, rarely solitary; sepals subequal, free or cohering at base, erect or spreading; petals usually smaller, often 2-lobed; lip spreading or drooping, long- or short-spurred at base, its blade entire or 3–5-fid.; column very short, sessile; rostellum usually 1-toothed or lobed; glands naked; anther-cells parallel or divergent: caps. ovoid or oblong, erect. The lateral lobes are sometimes fringed, giving the fl. a graceful appearance.—Species about 400, very widely distributed in temperate and tropical regions.

Few species of Habenaria are of much horticultural importance, especially in this country. Some of the exotic kinds enjoy some favor as stove plants in England, while there are a number of hardy North American species which can be recommended for outdoor cultivation in boggy places. *H. Susannæ*, *H. carnea*, *H. militaris* and other East Indian species are best grown in a moderately warm house, needing good light and a fair amount of water. It is recommended to repot them after the resting season in a compost of peat, moss, loam and crock dust, with the tuber resting upon the crocked-up bottom of the pot and the growing point just beneath the soil. They should then be given a good supply of water until after flowering. These habenarias are much like bletia in their requirements. The most popular species at present seem to be *H. ciliaris*, *H. fimbriata* and *H. psycodes*, but these give a very imperfect conception of the beauties of the genus, although in the opinion of some persons, *H. ciliaris* is the showiest orchid in temperate North America. The native species are procurable through collectors and dealers in native plants: foreign species through Dutch bulb-growers; and *H. radiata* through dealers in Japanese plants.

1775. Habenaria carnea. (×¼)

INDEX.

bifolia, 29.
blephariglottis, 15.
Bonatea, 19.
bracteata, 24.
carnea, 6.
chlorantha, 20.
ciliaris, 8.
cinnabarina, 10.
conopsea, 1.
cristata, 9.
dilatata, 35.
elegans, 32.
Elwesii, 15.
fimbriata, 4.
gigantea, 17.
gracilis, 33.
Hookeriana, 30.
Hookeri, 30.
hyperborea, 31.
integra, 7.
lacera, 23.
leucophæa, 22.
leucostachys, 14.
longecalcarata, 16.
militaris, 11.
nivea, 13.
nivosa, 6.
obtusata, 27.
odoratissima, 2.
orbiculata, 28.
peramœna, 3.
psycodes, 5.
pusilla, 11.
radiata, 21.
rhodocheila, 12.
Susannæ, 17.
tridentata, 25.
unalaschcensis, 34.
virescens, 26.
viridis, 24.

A. *Fls. purple; lip 3-parted: sts. leafy.*

B. *Segms. of lip entire: bracts nearly equaling the fls.*

1. **conópsea,** Benth. (*Gymnadènia conópsea*, R. Br. *G. conópea*, French authors). DEADMAN'S FINGERS. Fls. violet-purple to flesh-colored, rarely white, fragrant, medium-sized; spur longer than ovary, sometimes twice as long. June, July. Eu., N. Asia. G.C. III. 51:68.—There is an *H. conopsea* of Reichenbach dating from 1854, whereas Bentham's dates only from 1880.

2. **odoratíssima,** Franch. (*Gymnadènia odoratissima*, A. Rich.). Fls. intensely red-purple, aromatic, only half as large as in the preceding; spur shorter than ovary. May, June. Eu.

BB. *Segms. of lip toothed.*

3. **peramœna,** Gray. Rather tall: fls. large and showy, violet-purple; middle segms. of lip 2-lobed. July, Aug. N. J. to Va. and Ill. B.B. 1:466.

BBB. *Segms. of lip deeply and copiously fringed.*

4. **fimbriàta,** R. Br. Fls. lilac, rarely white, fragrant; petals laterally toothed. Summer. New Bruns. to Mich. and mountains of N. C. A.G. 12:152. G.F. 10:483. B.B. 1:466.

5. **psycòdes,** Gray. Three feet or less high: fls. many, crowded, much smaller than in *G. fimbriata*, lilac, rarely white, fragrant. July, Aug. Newfoundland to Minn. and high mountains of N. C. B.B. 1:466.

AA. *Fls. pink throughout: lvs. all radical.*

6. **cárnea,** N. E. Br. Fig. 1775. Lvs. dull green, spotted with white: fls. few, loosely clustered, light pink, fading nearly white; lip large; spur over 2 in. long. Penang. G.C. III. 10:729; 34:323. Gn. 47:182. G.M. 36:642. O.R. 4:209; 9:297; 11:frontis.; 13:59. G.F. 4:487. J.H. III. 33:319; 49:299. R.B. 21, p. 44. —One of the most beautiful of the genus; apparently not in American trade. Var. **nivòsa,** Hort., white. Gn. 47:182.

AAA. *Fls. orange.*

B. *Color orange-yellow throughout.*

C. *Lip nearly or quite entire.*

7. **íntegra,** Spreng. Two ft. or less high, leafy: fls. small, crowded. July. N. J. to La., near the coast. B.B. 1:463.

CC. *Lip fringed or lacerate.*

8. **ciliàris,** R. Br. YELLOW FRINGED ORCHIS. Fig. 1776. Fls. crowded, brilliant orange; petals fringed at apex; spur about twice as long as lip; lip long-fringed. Aug. E. U. S. B.M. 1668. B.B. 1:464.—A striking species.

9. **cristàta,** R. Br. Smaller: fls. much smaller; petals merely toothed; spur little exceeding the lip. July. N. J. to La. near the coast. B.B. 1:464.

BB. *Color cinnabar-orange, the sepals red-spotted outside.*

10. **cinnabarìna,** Rolfe. Small: st. leafy: lip 3-lobed; spur straight, nearly equaling ovary. Madagascar.—Not in American trade.

AAAA. *Fls. with green sepals and petals; lip brilliantly colored.*

11. **militàris,** Reichb. f. (*H. pusilla*, Reichb. f.). Bluish glaucous: fls. numerous; lip scarlet, trifid, mid-

lobe bifid; spur long and very slender, greenish white. Cochin-China. R.H. 1888:396. J.H. III. 33:53. G.M. 36:436. O.R. 4:209; 9:297.—The author says of this fine plant: "No English soldier can boast a jacket of a deeper scarlet than the lip of our plant." Not in American trade.

12. **rhodocheïla,** Hance. Nearly related to *H. militaris,* but fls. fewer and subcorymbose: petals almost helmet-shaped; lip varying from deep rose-pink to cinnabar and madder; spur dull yellow. China. B.M. 7571.—Not in American trade.

AAAAA. *Fls. white to green or greenish yellow.*

B. *Color pure white.*

C. *Lip entire.*

13. **nívea,** Spreng. Lvs., except 1 or 2 lowest, bract-like: fls. numerous, loosely clustered, small; spur very slender. Summer. Del. to Ala. B.B. 1:462.

14. **leucóstachys,** Wats. Usually tall and stout: lvs. several: fls. many, rather large. Idaho to Ariz., Calif. and Ore. Mn. 6:81.—Nearly related to *H. dilatata,* but distinguished by its spur greatly exceeding the sepals.

CC. *Lip fringed.*

15. **blepharigl6ttis,** Torr. Fls. much as in *H. ciliaris,* but somewhat smaller; petals fringed or slightly erose at apex; spur about 3 times as long as lip. July. Newfoundland to N. C. and Minn. B.B. 1:465. Mn. 8:113. —One of our finest natives.

CCC. *Lip 3-parted.*

16. **longecalcaràta,** A. Rich. Lvs. all radical: fls. 1–3, large, long-stalked; middle lobe of lip narrow, lateral ones broader, unevenly fringed; spur twice as long as ovary, with pedicel. July, Aug. India. B.M. 7228.—Not in American trade.

17. **Susánnæ,** R. Br. (*H. gigantèa,* Don). St. tall, stout, leafy: fls. 3–5, very large, fragrant; broad, fan-shaped side lobes of lip deeply fringed; midlobe tongue-shaped, entire; spur more than twice as long as ovary and pedicel. India, Malaya, China. B.M. 3374. G.C. III. 16:279. J.H. III. 29:226. O.R. 4:209; 9:297.—This and the preceding species are among the largest-fld. and showiest habenarias. They appear not to be in the North American trade.

1776.
Habenaria ciliaris, or yellow fringed orchid. (×¼)

BB. *Color partly or wholly green, or greenish yellow.*

C. *Lip deeply 3-lobed or 3-parted.*

D. *Petals cleft or parted into 2 lobes or segms.*

18. **Élwesii,** Hook. Erect, leafy: fls. few, large, greenish yellow; petals cleft almost to base into long, slender, sickle-shaped, hairy segms.; lip smooth, the segms. long and slender. India. B.M. 7478.—A remarkable species.

19. **Bonàtea,** Reichb. f. (*Bonàtea speciòsa,* Willd.). Stout, leafy: fls. rather large, light green and white; lobes of lip, especially central one, tubular toward base. S. Afr. G.C. III. 17:743.—Cult. like *Disa grandiflora,* in a cool greenhouse with plenty of air, in a mixture of fibrous peat and sphagnum with perfect drainage. Requires a liberal supply of water all the year round.

DD. *Petals not cleft or parted.*

E. *Spur sac-shaped; lobes of lip entire.*

20. **chlorántha,** Spreng. Lvs. clasping: fls. not exceeding bracts, greenish. Mascarene Isls.

EE. *Spur long and slender.*

F. *Middle lobe of lip entire, the others fringed.*

21. **radiàta,** Spreng. Petals exceeding sepals; spur greenish white, about equaling the ovary. Aug., Sept. Japan.

FF. *All lobes of lip deeply fringed.*

22. **leucophæa,** Gray. Four ft. high or less: fls. large, whitish or greenish, fragrant; petals erose; spur exceeding ovary. July. N.Y. to Minn. and Ark. B.B. 1:465.

23. **lácera,** R. Br. RAGGED ORCHIS. Smaller: fls. greenish yellow; spur not equaling ovary. June, July. Nova Scotia to Ga. and Mo. B.B. 1:465.

CC. *Lip merely toothed or slightly lobed; fls. inconspicuous.*

D. *Fls. much shorter than the conspicuous bracts; spur sac-shaped, short.*

24. **bracteàta,** R. Br. (*H. viridis,* Cham.). Fig. 1777. Fls. greenish; spur often white. Summer. N. E. U. S. to Brit. Col., Eu. B.B. 1:463.

DD. *Fls. nearly equaling or exceeding bracts; spur long and slender.*

E. *Lvs. 1–2 near base of st.*

25. **tridentàta,** Hook. Fls. greenish, loosely clustered; lip wide at apex, 3-toothed; spur incurved. July, Aug. Newfoundland to Minn., Fla. and La. A.G. 12:153. B.B. 1:463. Now known as **H. clavellàta,** Spreng.

EE. *Lvs. 3 or more.*

26. **viréscens,** Spreng. Leafy: fls. greenish; lip only slightly exceeding petals, with 2 lateral teeth and a nearly basal wart. July. Range of preceding. B.B. 1:464. The name is now **H. flàva,** Gray.

CCC. *Lip entire; fls. inconspicuous.*

D. *Large lvs. all basal.*

E. *Lf. solitary.*

27. **obtusàta,** Richards. Spike loosely fld.; fls. yellow-green; lip deflexed; spur about equaling lip. Summer. Across Canada, south to N. Y. and Colo. B.B. 1:461.

EE. *Lvs. 2.*

F. *Spur much exceeding ovary.*

28. **orbiculàta,** Torr. Lvs. orbicular, lying on the ground: fls. numerous, loosely clustered, greenish; lip white, obtuse. July, Aug. Across Canada and Minn. to mountains of N. C. B.B. 1:461. Gn.M. 4:14.

29. **bifòlia,** R. Br. BUTTERFLY ORCHIS. Lvs. oblong: fls. white, with tips of spur and lip greenish, fragrant in the evening. May, June. Eu.

FF. *Spur about equaling ovary.*

30. **Hookeriàna,** Gray (*H. Hoòkeri,* Lindl.). Lvs. oval, obovate or orbicular: fls. greenish yellow; lip acute. Summer. Nova Scotia to N. J. and Iowa. B.B. 1:461.

DD. *Large lvs. several above the base.*

E. *Spike commonly dense.*

31. **hyperbòrea,** R. Br. Fls. greenish; petals, obtuse lip and slender spur all about equally long. Summer. N. U. S. to Nova Scotia and Alaska. B.B. 1:462.

32. **élegans,** Boland. Large lvs. all on lower part of st.: fls. numerous, small, greenish; sepals 1-nerved, all alike; spur filiform. Vancouver Isl. to Calif.

EE. *Spike commonly loose.*

F. *Spur short, sac-shaped.*

33. **grácilis,** Wats. Three feet high or less: spike long, many-fld.; fls. greenish; spur about equaling lip and sepals. Ore. and Wash.

FF. *Spur not sac-shaped.*

34. **unalaschcénsis,** Wats. Fls. white or greenish; sepals, petals and lip about equal; spur slender, barely to nearly twice longer than lip. Summer. Unalaska to Calif. and Utah.—Near *H. elegans,* but more slender, with a longer and more open spike. It is referred by some to the genus Herminium.

35. **dilatàta,** Gray. Fls. greenish white; lip widened or even auricled at base; spur about as long, incurved. Summer. Cooler parts of N. Amer. A.G. 12:153. B.B. 1:462.—More slender and narrower-leaved than *H. hyperborea.*

H. geniculàta, D. Don. Slender-growing: fls. white with green spur. Burma, Himalayas. —*H. iántha,* Hook. (Platanthera iantha, Wight). Deciduous, about 16 in. high: fls. shortly stalked, creamy white; lip large, rose-purple and white with crimson-purple dots and streaks; crest bright yellow. S. India. G.C. III. 54:300.—*H. Lúgardii,* Rolfe. Lvs. 2, basal: raceme many-fld.; fls. white, the stylodes green; sepals ovate, acute; petals divided into 2 slender lobes. Bechuanaland. B. M. 7798.—*H. Régnieri.* Garden hybrid of H. militaris and H. carnea.—*H. Roebelénii.* Rolfe. Similar to H. militaris but dwarfer: fls. vermilion-scarlet; lip broad, deeply cleft at the sides. Annam. O.R. 1913:39. —*H. triquètra,* Rolfe. Plant somewhat glaucous: racemes about 10-fld.; petals white; sepals light green. Burma.

1777. Habenaria bracteata. (×⅓)

T. H. KEARNEY, JR.
GEORGE V. NASH.†

HABÉRLEA (after Karl C. Haberle, professor of botany at Pesth, who died in 1831). *Gesneriàceæ.* One dainty little hardy herbaceous perennial plant, which is tufted and bears in spring a few scapes 4 to 6 inches high, with two to five nodding, violet-colored, five-lobed, tubular flowers, each about 1 inch long and 1 inch across. Allied to Ramondia.

Haberlea has 4 included didynamous stamens and a bell-shaped calyx; the corolla has a conspicuous tube, which is thrust out of the calyx nearly ½in., and 5 lobes, 2 of which are much smaller than the others, while in Ramondia the fl. seems to be wheel-shaped, with 5 equal petals, because the corolla-tube is very short and inconspicuous and the lobes deeply cut. Haberlea was intro. to cult. about 1881 by Leichtlin, and few, if any, of our skilled amateurs know the plant. It is not advertised in Amer. Only 1 species is known, and it is found wild only in a few miles of a single valley in Thrace, where it abounds on the southern slope of the Balkans on shaded schistose rocks. Only 4 species of Gesneriaceæ are found wild in Eu., and 3 of them, are said to be confined each to one spot. The genus Ramondia has the same habit and is equally desirable. For cult., see *Ramondia.*

rhodopénsis, Friv. Like a very small gloxinia, and clothed everywhere with soft, spreading hairs, except the corolla: lvs. 2–3 in. long, obovate- or ovate-oblong, obtuse, coarsely crenate, thick, leathery, few-nerved: calyx 5-cleft; corolla pale lilac. B.M. 6651. Gn. 67, p. 71. G.W. 15:428. R.H. 1906, p. 231.

WILHELM MILLER.

HABRÁNTHUS: *Hippeastrum.*

HABROTHÁMNUS: *Cestrum.*

HACKBERRY: *Celtis.*

HACKMATACK, or TAMARACK: *Larix americana.*

HACQUÈTIA (named after Balthasar Hacquet, 1740–1815, author of works on alpine plants). *Umbellíferæ.* Syn. *Dóndia, Dondísia.* A monotypic genus consisting of an herbaceous perennial cult. in the alpine garden and thriving in good stiff loam. Prop. by division in spring, before growth commences. The species is *H. Epipáctis,* DC. From 3–8 in. high: lvs. radical, palmate, deeply lobed: fls. polygamous, in umbels on short pedicels, yellow; involucre of 5–6 large, green lvs. which are much longer than the umbels. Eu. L.B.C. 19:1832. G.W. 14, p. 197.—Blooms in April and May.

HÆMÁNTHUS (*blood flower*). *Amaryllidàceæ.* BLOOD LILY. African bulbous plants, of which the greater part are natives of the Cape region; grown indoors.

Flowers showy, often numerous, in umbels; perianth straight and erect, with a short cylindrical tube; segms. longer than the tube, narrow, equal; stamens 6, inserted in the throat of the perianth, usually exserted, the anthers versatile; style filiform and erect, on a 3-loculed ovary: fr. berry-like, indehiscent. The fls. are red or white, on a solid scape, which is little, if any, longer than the cluster of root-lvs.; they lack the corona of many amaryllidaceous plants.—Probably above 60 species from S. and Trop. Afr.

Hæmanthuses, like most Cape bulbs, are summer- and autumn-flowering; or, when started indoors or in frames, blooming in spring or early summer. The flowers often precede the leaves. The foliage is usually large and luxuriant, and the scape is often handsomely colored. The flowers are sometimes as much as 2 inches across, and produced in great ball-like heads nearly or quite a foot through. Yet the species are essentially curiosities in this country. The culture given nerine suits them well. Their season of growth is usually not more than three or four months, and the remainder of the year they may be laid away in the pots. When growing, give plenty of rather weak liquid manure, keep in an intermediate or warm house, and when in bloom keep them somewhat cooler. Avoid overpotting.

They are increased by offsets, which should be detached from the parent plants in the spring. The bulbs may be potted singly, or several in a pot, in equal parts of peat and loam, with enough sand to make the compost have a gritty feeling when passed through the hands. Cover the lower half of the bulb with soil and pot them firmly. Leaf-mold may be used instead of peat, if that soil is not available. Hæmanthus will grow well in a night temperature of 50° to 55°. However, they are often grown 10° lower, but never with the same success. Water the plants carefully until they get into active growth, after which water may be applied more liberally. Syringe the plants on all bright days, morning and noon during their growing period. During the summer months, shade them slightly; and when they are in flower the shade may be much heavier. This is of great assistance in making them last longer. As soon as the plants show signs of going to rest, withhold water, letting the soil become quite dry. Start them into growth in the spring about the first of March. It is not necessary to pot these plants every year, as they flower much better if not disturbed much at the roots. If they are not repotted, water with weak liquid manure once a week, after they are growing vigorously. These plants are liable to attacks from green-fly and red-spider. Fumigation with tobacco, in any form generally used in greenhouses, will keep the former in check; and on bright days, a careful syringing of the under side of the foliage with clean water will keep the latter from getting a foothold. (George F. Stewart.)

INDEX.

albiflos, 7.
candidus, 8.
Clarkei, 7.
coarctatus, 9.
coccineus, 9.
imperialis, 4.
insignis, 6.
Kalbreyeri, 2.
Katherinæ, 3.
Laurentii, 4.
Lescrauwaetii, 1.
Lindenii, 4.
magnificus, 6.
mirabilis, 4.
multiflorus, 2.
pubescens, 7.
puniceus, 5.
superbum, 2.
tenuiflorus, 2.
tigrinus, 10.

A. *Lvs. membranous, not fleshy.*

B. *Perianth-parts and spathes spreading.*

C. *Peduncle lateral as regards the tuft of lvs.*

D. *Segms. of perianth. ½in. long or less.*

1. **Lescraûwaetii,** Wildem. Lvs. sheathed at the base, 4–8 in a group, about 7–8 in. long, with 8–9 nerves on each side of the midrib: infl. racemose, the ultimate,

1778. Hæmanthus Katherinæ. (×¼)

umbellate clusters almost round, about 4 in. diam.; fls. rose-colored, showy, the tube short, the segms. linear, about ⅓in. long. Congo region. R.B. 30:217. —Intro. in 1904.

DD. *Segms. of perianth. ¾–1 in. long.*

2. **multiflòrus,** Martyn (*H. tenuiflòrus*, Herb. *H. Kálbreyeri*, Baker). Bulb globose, 3 in. or less diam.: lvs. 3–4 on a short, separate st., the petiole short and sheathing, the oblong blade 6–12 in. long, with 6–8 veins each side of the midrib: scape straight, 1–3 ft. high, green or red-spotted; umbel often 6 in. diam., containing 30–100 fls., which are usually blood-red, with linear 3-nerved segms. twice or more as long as the tube; red filaments long-exserted, bearing prominent yellow anthers. Trop. Afr. Variable. B.M. 961, 1995, 3870. L.B.C. 10:912; 20:1948 (erroneously as *H. puniceus*). F.S. 1:58; 23:2377. I.H. 26:354. G. 25:445. Gt. 53:1531. G.W. 4, p. 557. G.Z. 25, p. 170. Var. **supérbus,** Hort., is an improved brilliant-colored form.

3. **Kátherinæ,** Baker. Fig. 1778. Bulb globose, 2–3 in. diam.: lvs. 3–5, on a short, separate st. appearing with the fls., with a short, spotted petiole, the blade oblong, 9–14 in. long and 4–6 in. broad, the lateral veins 8–10: peduncle 1 ft. tall, spotted toward the base; umbel sometimes 9 in. diam., densely many-fld.; fls. bright red, 2–2½ in. long, the lanceolate reflexing segms. little longer than the cylindrical tube; red filaments exserted. S. Afr. B.M. 6778. G. 32:37. G.C. III. 43:72.—Name spelled both *Katherinæ* and *Katherine*; but the former spelling is the original and the proper Latin form. In cult. the lvs. become "about 3 ft. in length and of a bright pale green color—apple-green, as it is usually called—and the venation is more strongly marked than is usual in *H. multiflorus*, *H. cinnabarinus* and other allied kinds." Burbidge, Gn. 49, p. 160, with figure.

CC. *Peduncle central as regards the tuft of lvs.*

4. **Líndenii,** N. E. Br. Lvs. 6–8, in 2 ranks, arising from a thick, solid rootstock, nearly or quite evergreen; petioles long, winged; blade 10–12 in. long and 3–5 in. wide, long-ovate, lanceolate or ovate-oblong, acute, the base rounded or subcordate, with a longitudinal fold either side of the midrib: scape 1½ ft. tall, arising from the center of the lvs., flattened on one side, more or less spotted: umbel globular, 6–8 in. diam., with 100 or more scarlet fls. opening in succession; fls. 2 in. across, the tube ¾in. long, the lobes longer and linear-lanceolate and acute. Congo. G.C. III. 8:437; 13:483. I.H. 37:112; 40:173, f. 1; 41, p. 18. Gt. 46, p. 217. G.M. 36:220. J.H. III. 28:73.—Many forms are known in the trade, as var. **mirábilis,** Hort., with salmon-colored fls., a magnificent addition intro. in 1901. G. C. III. 29:332. Var. **imperiàlis,** Hort., differing from the type in longer perianth-segms. G.C. III. 31:99. G.M. 45:85. Var. **Laurèntii,** Hort., also with longer perianth-segms., and salmon-colored fls. R.H. 1911, p. 443. There are many other forms of this popular favorite, such as "Fascinator," "Queen Alexandra," and the like.

BB. *Perianth-parts and spathes ascending.*

5. **puníceus,** Linn. Bulb nearly globular, 2–3 in. diam.: lvs. 2–4, from the bulb, the petiole half the length of the blade, the blade 6–12 in. long and 2–4 in. broad, oblong, strongly undulated, the main veins about 6 on each side the rib: scape 6–15 in. tall, spotted; umbel globose and dense, 3–4 in. diam., bearing many scentless, pale scarlet, yellowish red or rarely white fls. 1 in. long; perianth-tube cylindrical, shorter than the lanceolate 3-nerved segms.; filaments red, 1 in. long. S. Afr. B.M. 1315.

6. **magnificus,** Herb. Bulb globose, 3–4 in. diam.: st. leafy, reaching a length of 2 ft., not developed until after flowering time: lvs. 6–8, oblong, 12–15 in. long, narrowed to a clasping base: peduncles stout, about a foot long, the umbel globose, about 5 in. diam.; fls. bright scarlet, the segms. about twice the length of the tube. Perhaps only a variety of *H. puniceus* and so treated in B.M. 3870. B.M. 4745 figures a var. **insígnis,** Hook., with long green bracts.

AA. *Lvs. thick and fleshy.*

B. *Bracts and fls. white.*

7. **álbiflos,** Jacq. Bulb or tuber compressed sidewise, with thick, 2-ranged scales: lvs. 2–4, appearing with the fls., nearly erect, obtuse, 6–8 in. long and nearly half as broad, narrowed to the base, green and glabrous, but ciliate on the edges: scape less than 1 ft. tall, pale green, bearing a dense, globular umbel 2 in. diam.; fls. ¾in. long, the linear segms. much exceeding the tube. S. Afr. B.M. 1239. L.B.C. 7:602. Var. **pubéscens,** Baker, has lvs. hairy above. L.B.C. 8:702. B.R. 382. *H. Clárkei*, Hort., is a hybrid of this species and *C. coccineus*.

8. **cándidus,** Bull. Bulb large, globose: lvs. 2, appearing with the fls., fleshy, strap-shaped, about 1 ft. long, 4–5 in. wide, hairy on both sides: peduncle as long as

the lvs., very hairy; heads when expanded 5 in. diam., very showy, white; perianth-tube cylindrical. Natal.

BB. *Bracts and fls. red.*

9. **coccíneus,** Linn. Bulb compressed sidewise, 3 in. diam., the scales many, thick, 2-ranged: lvs. 2, suberect, lingulate, reaching 2 ft. long and 8 in. broad, narrowed to the base, green and glabrous, not ciliate: scape 6–10 in. tall, compressed, mottled; bracts large and thick, ascending and forming a cup, in which the red fls. are borne; fls. 1 in. long, with linear segms. and a short tube. S. Afr. B.M. 1075. L.B.C. 3:240. Var. **coarctàtus,** Baker, has smaller lvs. and shorter bracts. B.R. 181.—Odd plants.

10. **tigrìnus,** Jacq. Lvs. ciliate on the margins, 1 ft. or less long, spotted on the lower part of the back: scape 6 in., red-spotted; umbel dense, 2 in. or less in diam.: bracts shorter than in the last (not over 2 in. long), bright red; fls. 1 in. or less long, with very short tube. S. Afr. B.M. 1705.

Many hybrids and forms are known in horticulture. Among the best is *H. Andrómeda* which is H. Katherinæ × H. magnificus. Fls. crimson. Gn. 76, p. 437. G.M. 55:589.—*H. toxicárius*=Buphane disticha.

L. H. B.
N. TAYLOR.†

HÆMÀRIA (Greek, referring to the blood-red under surface of the leaves). *Orchidàceæ.* Terrestrial orchids, known to the trade chiefly as Goodyera. They are really dwarf stove foliage plants, and are to be cultivated like Anœctochilus.

In Hæmaria the lower lip is swelled above its base into a wide claw and is provided with a pouch-like sac at base, and a blade of 2 divergent lobes; in Goodyera the blade of the lip is small and not clawed. Both genera belong to a large group in which the lip either has no spur or sac, or if the latter is present, it is included between the sepals; while in Anœctochilus the lip has a prominent sac or spur projecting between the lateral sepals.—Four species, in China and Malaya.

The leaves of *H. discolor* are green above and red below. It is, however, not nearly so brilliant as *Hæmaria Dawsoniana,* which has the same red color beneath, and is beautifully netted above with red or yellow. In both species a dozen or more small flowers, chiefly white, are borne on a densely hairy scape. These plants seem much easier to cultivate than anœctochilus and can be grown in large, shallow pans, with the rhizomes creeping in sphagnum.

A. *Lvs. not netted-veined above.*

díscolor, Lindl. (*Goodyèra díscolor,* Ker). Fig. 1779. Blade of lvs. oblong, 3 in. long, ¾in. wide. China (Brazil, according to Loddiges). B.M. 2055. B.R. 271.—Some plants have white longitudinal markings.

AA. *Lvs. brilliantly netted-veined above.*

Dawsoniàna, Hassl. (*Goodyèra Dáwsonii,* Boxall. *Anœctochìlus Dawsoniànus,* Low). Blade of lvs. elliptic, 3 in. long, 1¼ in. wide. Burma, Philippines. B.M. 7486 (veins of 2 lvs. blood-red; of the other almost wholly yellow) G. 34:101. G.C. III. 35:387.

HEINRICH HASSELBRING.

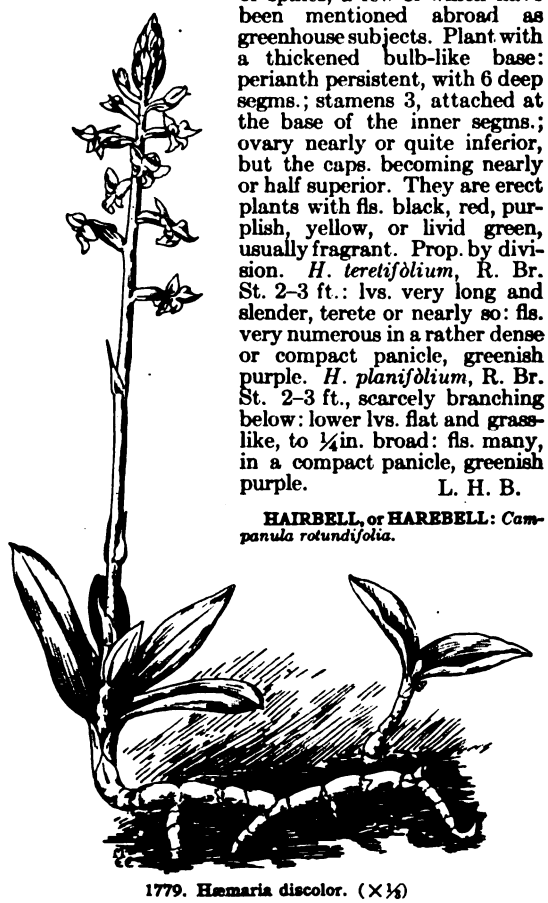
HÆMATÓXYLON (from the Greek for *blood* and *wood,* in reference to the color of the latter). *Leguminòsæ.* Two or 3 species of trees from Mex., Cent. Amer. and W. Indies, of which the most important, *H. campechiànum,* Linn., furnishes the logwood of commerce. It is a medium-sized tree, reaching 30–45 ft., with a short crooked trunk: lvs. abruptly pinnate; lfts. obversely egg-shaped: fls. small, yellow, in axillary racemes; petals 5, oblong, expanding; stamens free, rather upright, with filaments hairy at base; ovary short-stiped, free, with 2–3 seeds: pod lanceolate, flattened, dehiscing along the median valve in 2 boat-shaped pseudo-valves.—The wood is very hard and heavy, the heart-wood, from which the sapwood has been removed, being used for making the dye. The wood takes on a beautiful brownish red color on exposure to the air. This tree is known as Campeachy wood, logwood, and in Porto Rico as Palo de Campeche.

L. H. B.

HÆMODÒRUM (*blood-gift,* a fanciful name). *Hæmodoràceæ,* which is closely allied to Amaryllidaceæ. Nearly 20 Australian perennial herbs, with sheathing equitant lvs. and different colors of fls. in heads, cymes or spikes, a few of which have been mentioned abroad as greenhouse subjects. Plant with a thickened bulb-like base: perianth persistent, with 6 deep segms.; stamens 3, attached at the base of the inner segms.; ovary nearly or quite inferior, but the caps. becoming nearly or half superior. They are erect plants with fls. black, red, purplish, yellow, or livid green, usually fragrant. Prop. by division. *H. teretifòlium,* R. Br. St. 2–3 ft.: lvs. very long and slender, terete or nearly so: fls. very numerous in a rather dense or compact panicle, greenish purple. *H. planifòlium,* R. Br. St. 2–3 ft., scarcely branching below: lower lvs. flat and grass-like, to ¼in. broad: fls. many, in a compact panicle, greenish purple.

L. H. B.

HAIRBELL, or HAREBELL: *Campanula rotundifolia.*



1779. Hæmaria discolor. (×⅓)

HÀKEA (after Baron von Hake, a German friend of botany). *Proteàceæ.* Australian evergreen shrubs cultivated indoors abroad, much used for ornamental planting in the open in California.

The foliage of the various species of Hakea is exceedingly diverse; in some the lvs. are flat and broad, and then entire or merely toothed, in others they are terete, and then either simple and entire or pinnately parted: fls. in pairs, the pairs commonly crowded in close racemes or globose clusters, these mostly sessile in the lf.-axils; corolla-tube slender, usually recurved beneath the limb, which is mostly globose, the 4 lobes cohering long after the tube has opened; lobes concave and bear sessile anthers; the single style either long or short but always dilated at the end: fr. a hard woody caps. opening in 2 valves and bearing 2 compressed winged seeds.—Ninety-five species are fully described in English, with a key in Flora Australiensis 5:489 (1870). Eleven species grown in Calif. are described and discussed, with a key and 8 illustrations in Univ. Calif. Pub. Botany 4:14–20 (1910).

Hakeas are drought-resistant plants which endure

moderate frost and are therefore well adapted to the drier parts of the South and Southwest. In California they are grown as far north as Sacramento. One of these, *H. laurina*, produces strikingly handsome fls.; *H. elliptica* is prized for the bronze color of its young foliage; while the spiny-leaved species are serviceable for planting in public parks or in any place where it is necessary for shrubs to protect themselves from pedestrians or vandals.

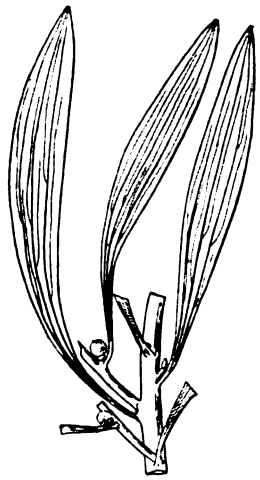
Hakeas may be propagated by cuttings taken from ripened shoots but they are almost universally grown from seeds. These are gathered from year-old capsules which are very hard and must be dried for some time before they will open. The seeds are sown in winter or early spring in the ordinary mixture of sand, leaf-mold, and loam; they germinate easily, even without heat. The young seedlings are pricked off into boxes and held in the lathhouse for a season before planting in the open. For best results hakeas should be grown in light, well-drained soil and need but little water after they are once established; much moisture is injurious except during the summer months.

A. *Lvs. ¼in. or more wide.*

B. *Margins of lvs. flat, entire.*

salígna, Knight. A pale shrub, to 8 ft. high, glabrous except the young shoots: lvs. oblong or lanceolate, 3–6 in. long, obtuse, often callous-tipped, tapering to a short petiole, pinnately veined: fl.-clusters white, small but numerous, dense, sessile; corolla glabrous, recurved: fr. about 1 in. long, ½–¾in. broad, with short incurved beak, roughish.

laurina, R. Br. (*H. eucalyptoìdes*, Meissn.). Sea Urchin. Fig. 1780. Tall shrub, to 30 ft., and tree-like in Austral.: lvs. elliptic or lanceolate, 5 or 6 in. long, ½–1 in. wide, tapering to a petiole; principal veins 3–7, nearly parallel: fls. crimson, in a globular involucrate head, 1½–2 in. thick, from which the numerous showy golden yellow styles project 1 in. or so in every direction: fr. ovoid, about 1¼ in. long by ¾in. broad, short-beaked. B.M. 7127. G.C. II. 23:149.—The only species with showy fls. here described; equally satisfactory for shrubberies and for hedges; always highly ornamental. In Italy it has been called "the glory of the gardens of the Riviera."



1780. Hakea laurina. (×½)

BB. *Margins of lvs. undulate.*

ellíptica, R. Br. Fig. 1781. Erect shrub, 6–15 ft.: lvs. oval or elliptic, nearly sessile, 2–3½ in. long, 1–1¼ in. wide, undulate-margined; veins 5–7, parallel, connected by cross-veinlets: fls. white, in globose sessile clusters: fr. ovoid, 1–1¼ in. long, ¾in. broad, obliquely beaked.—Foliage by far the finest of all intro. kinds, the rich bronze color of the young shoots hardly rivaled among other shrubs. The compact, erect habit makes it eminently suitable for general lawn and shrubbery planting.

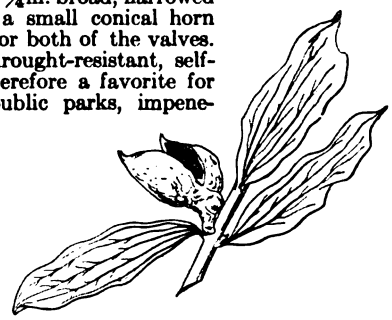
AA. *Lvs. or their lobes ⅛in. or less wide, mostly terete.*

B. *Lf.-veins several: lvs. linear, flat.*

ulícina, R. Br. Shrub with erect branches and dense foliage resembling ulex: lvs. narrowly linear, acute, flat, entire, 1–8 in. long, rarely over ⅛in. wide, prominently 1–3-nerved beneath: fls. very small, glabrous: caps. mostly under ½in. long, the beak short and straight. Var. **carinàta,** F. Muell. (*H. carinàta*, F. Muell.). Lvs. mostly 1-nerved beneath, nerveless above.

BB. *Lf.-veins none.*

suavèolens, R. Br. (*H. pectinàta*, Colla). Rounded shrub, 8–15 ft.: lvs. 2–4 in. long, terete, with rigid spine-like tip, occasionally entire, usually branched into 1–5 rigid terete lobes of unequal lengths: pedicels and perianth glabrous; fls. white, fragrant: fr. ovoid, about 1 in. long by ¾in. broad, narrowed at apex and with a small conical horn near the end of 1 or both of the valves. —Easily grown, drought-resistant, self-protective, and therefore a favorite for depot grounds, public parks, impenetrable hedges, and the like. Makes a suitable covering for dry hillsides, although not deep-rooted and sometimes inclined to become top-heavy.



1781. Hakea elliptica. (×½)

aciculàris, R. Br. Tall shrub, more slender than the preceding: mature twigs glabrous: lvs. awl-like, simple and entire, 1–3 in. long: pedicels white, silky; the corolla glabrous: fr. ovoid, about 1 in. long, fully ½in. broad, rough, narrowed to a thick beak, each valve with a conic brown horn near apex.—Used for purposes indicated under *H. suaveolens*.

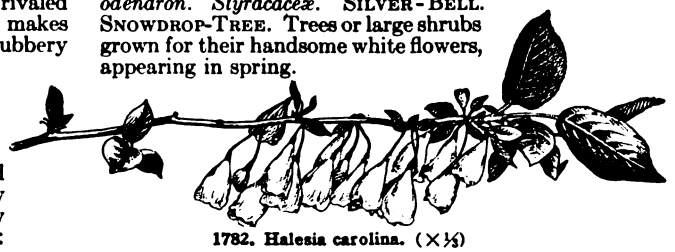
gibbòsa, Cav. Spreading shrub, 6–10 ft., with characters of *H. acicularis* but twigs and young lvs. short-hirsute and fr. larger, about 1½ in. long, nearly 1 in. broad, abruptly narrowed to a short oblique beak, similarly horned. Bot. Cook's First Voy. 266.

pugionifórmis, Cav. Near *H. acicularis* and *H. gibbosa* but to 20 ft. high and corolla as well as pedicels pubescent: fr. much more slender, lanceolate, acuminate, 1 in. long by ¼in. broad, rough around the middle, with an obliquely transverse crest, each valve tapering to a slender point. L.B.C. 4:353. Bot. Cook's First Voy. 265.—Often labeled *H. suaveolens* in nurseries but distinguished from that by the simple lvs. and thicker frs.

H. aquifòlia, is a garden name sometimes applied to H. saligna. —*H. cyclocárpa*, Lindl. Foliage as in H. laurina but lvs. and fr. larger, the fl.-heads not involucrate: corolla silky-pubescent. Once offered by Franceschi.—*H. multilinèata*, Meissn. Related to H. laurina: lf.-veins more numerous: fl.-clusters oblong: fr. only ½in. broad. G.C. III. 19:85 (var.). Reported but apparently never intro.—*H. nítida*, R. Br. Lvs. bright green, oblong, entire or toothed: fls. white, in stalked clusters: fr. 1 in. long by ¼in. broad. B.M. 2246.—*H. undulàta*, R. Br. Lvs. glabrous, obovate or rarely lanceolate: fls. small, in axillary clusters: fr. recurved at base, 1¼ in. long by ¾in. broad, distinctly beaked.—*H. sdria*, R. Br. Some lvs. with nearly terete lobes, then resembling H. suaveolens, but varying to flat and holly-like, 1–2 in. long, obscurely veined or veinless, always tapering at the base: fls. in small clusters, the rachis villous, pedicels and small corolla glabrous: fr. ¾in. long by ½in. broad. Offered by Franceschi.

Harvey Monroe Hall.

HALÈSIA (Stephen Hale, 1677–1761, author of a famous work on "Vegetable Statics"). Syn. *Mohrodéndron*. *Styracàceæ*. Silver-Bell. Snowdrop-Tree. Trees or large shrubs grown for their handsome white flowers, appearing in spring.



1782. Halesia carolina. (×½)

Deciduous and more or less stellate-pubescent: lvs. short-petioled, without stipules, involute in bud, denticulate: fls. in axillary clusters or short racemes on branchlets of the previous year; calyx-tube obconical, slightly 4-ribbed, with 4 minute teeth; corolla campanulate, 4-lobed or nearly 4-parted, white; stamens

1783. Halesia carolina var. Meehanii. (×½)

8–16; style slender; ovary inferior, 2–4-celled, with 4 ovules in each cell: fr. an oblong, dry drupe with 2–4 longitudinal wings; stone 1–3-seeded.—Three species in N. Amer.

The snowdrop-trees are large shrubs or trees with rather large bright green generally oblong and short-stalked leaves and white slender-stalked drooping bell-shaped flowers appearing before or with the leaves and followed by winged light brown fruits. *Halesia carolina* is hardy as far north as Massachusetts and is very handsome in spring when covered with its white flowers. *Halesia diptera* is hardy as far north as Philadelphia and is usually a smaller plant, but has larger flowers and leaves. They thrive in almost any good soil, but prefer a rich well-drained soil and a sheltered position; they are easily transplanted. Propagation is by layers or root-cuttings in spring or autumn; also by greenwood cuttings taken from forced plants. Seed should be sown at once or stratified; if allowed to become dry, it does not germinate until the second or sometimes the third year.

carolina, Linn. (*H. tetráptera,* Ellis. *Mohrodéndron carolínum,* Brit.). Fig. 1782. Large shrub or small tree, usually not higher than 40 ft., with spreading branches and often irregular in habit: lvs. ovate or elliptic to ovate-oblong, acute or acuminate, cuneate or rounded at the base, finely serrate, glabrous above, stellate-pubescent below, 2–4 in. long: fls. in clusters of 2–4; corolla 4-lobed, ½–¾in. long; stamens 10–16; ovary 4-celled: fr. 4-winged, 1–1½ in. long. April, May. W. Va. to Fla., west to Ill. and E. Texas. B.M. 910. Mn. 5, p. 194. S.S. 6:257. Gng. 2:247. A.G. 14:211; 18:438. M.D.G. 1899:352, 353. G. 3:526; 10:485. G.C. III. 51: suppl. Feb. 3. Gn. 75, p. 582. Gn.M. 8:22. J.H. III. 44:140. G.W. 5, p. 79. G.M. 55:823. Var. **dialypétala,** Schneid. Corolla divided nearly to the base. Var. **monticola,** Rehd. Pyramidal tree to 90 ft.: lvs. larger, generally oblong-obovate, glabrescent or nearly glabrous below, more sharply serrate: pedicels and calyx glabrous; corolla large: fr. 1½–2 in. long, obcordate at the apex, wings broad. N. C. to Ala., in the mountains. Apparently hardier than the type. Var. **Meèhanii,** Perkins (*H. Meèhanii,* Meehan). Fig. 1783. Bushy upright shrub or small tree: lvs. thicker, smaller, more rugose, darker green, more distinctly serrate, pubescent below: fls. smaller, cup-shaped, shorter pedicelled. A very peculiar form of garden origin; very unlike the species and less ornamental; suggests a hybrid of some kind. G.F. 5:535 (adapted in Fig. 1783).

díptera, Ellis (*Mohrodéndron dípterum,* Brit.). Shrub or small tree, to 30 ft.: lvs. ovate to obovate, rarely oblong, remotely serrate, soft-pubescent beneath, 3–5 in. long: fls. 2–4, in short racemes; corolla deeply lobed nearly to the base, puberulous outside; stamens usually 8; ovary usually 2-celled: fr. oblong with 2 broad wings and often with 2 or sometimes 3 obsolete supplementary ones, 1½–2 in. long. April. S. C. and Tenn. to Fla. and Texas. S.S. 6:259.

H. corymbósa, Nichols.=Pterostyrax corymbosa.—*H. hispida,* Mast.=Pterostyrax hispida.—*H. parviflóra,* Michx. Shrub, resembling H. carolina: lvs., pedicels, and calyx densely pubescent: corolla ⅓–½in. long: fr. 2-winged. Ga. to Fla.

ALFRED REHDER.

HALIMODÉNDRON (Greek, *maritime tree;* referring to its habitat in saline soils). *Leguminósæ.* Ornamental shrub grown for its handsome profusely produced flowers.

Deciduous: lvs. slender-stalked, with 1 or 2 pairs of lfts. and with the persistent petiole becoming usually spinescent: fls. in lateral slender-stalked, 2–3-fld. racemes; calyx cup-shaped with 5 short teeth; corolla papilionaceous; petals of nearly equal length; standard orbicular with the sides reflexed; keel obtuse, curved; stamens diadelphous; ovary stipitate with many ovules, style filiform, curved: pod stipitate, ellipsoid or obovoid, inflated, tardily dehiscent, with few kidney-shaped glossy brown seeds. — One species in the salt steppes of Cent. Asia from Transcaucasia to the Altai.

1784. Halimodendron halodendron. (×⅓)

This is a wide-spreading shrub with slender branches and small bluish green foliage, covered in early summer with numerous pale violet or rosy purple flowers. The small pale foliage and the slender-stalked drooping flowers combined with the spreading habit give to the plant a gracefulness and airiness of its own and make it a very desirable ornamental shrub. It is perfectly hardy North, resists drought and heat well and thrives in sandy as also in saline and alkaline soils. Propagation is by seeds and by layers which root slowly; it also may be grafted on laburnum or caragana.

halodéndron, Voss (*H. argénteum,* Fisch.). SALT TREE. Fig. 1784. Shrub, to 6 ft.; the young growth silky-pubescent: lfts. 2 or 4, oblanceolate, rounded and mucronate at the apex, grayish or bluish green,

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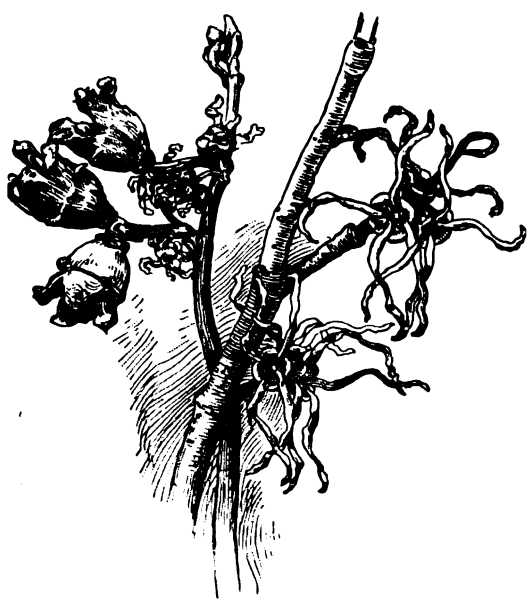
minutely silky, becoming sometimes nearly glabrous with age, ½–1½ in. long: fls. 2–3, on slender peduncles about ¾in. long, lilac or pale purple, about ¾in. long: pod ¾–1 in. long; seeds about ⅛in. long. June, July. B.M. 1016. Var. **purpûreum,** Schneid. (*H. argénteum fl. purpùreo,* Hort. *H. speciòsum,* Carr.). Fls. bright rosy purple. R.H. 1876:30. ALFRED REHDER.

HALLÈRIA (Albrecht von Haller, 1708–1777, Swiss physician and naturalist, and professor at Göttingen). *Scrophulariàceæ.* About 6 species of shrubs or small trees from Afr. and Madagascar with opposite, ovate or elliptic, entire or serrate lvs. and axillary, solitary or fascicled fls.: calyx cup-shaped, 3–5-cleft; corolla trumpet- or funnel-shaped with short 4–5-lobed oblique limb; stamens 4, didynamous, inserted about the middle of the tube, about as long as or longer than the corolla; ovary 2-celled; style slender: fr. a berry with several or numerous compressed seeds. Only the following species is sometimes cult. in S. Calif. and as a greenhouse plant abroad for its red fls. and the lustrous nearly evergreen foliage. It is easily prop. by cuttings under glass and by seeds. **H. lûcida,** Linn. Shrub or small tree, to 30 ft., glabrous: lvs. petioled, ovate, acuminate, serrate, 1–4 in. long: fls. in axillary clusters on stalks ¼–½ in. long, tubular, curved and bulged on one side, shortly 2-lipped, red, sometimes yellowish at the base, about 1 in. long; stamens and style exserted: berries subglobose, deep purple, edible. S. and Trop. Afr. B.M. 1744. Sometimes called African honeysuckle.

ALFRED REHDER.

HALOPHŸTUM: *Hoplophytum.*

HAMAMÈLIS (Greek, *hama,* together, and *melon,* apple or fruit: fruits and flowers at the same time). *Hamamelidàceæ.* WITCH-HAZEL. Ornamental woody plants chiefly grown for their yellow flowers appearing late in autumn or in the winter.



1785. Witch-hazel, Hamamelis virginiana, showing flowers and fruits. (Natural size)

Deciduous shrubs or small trees; stellate-pubescent: lvs. alternate, short-petioled, stipulate, sinuate-dentate: fls. in short-peduncled, nodding, axillary, few-fld. clusters, perfect; calyx 4-parted; petals 4, linear, crumpled; stamens 4, very short, alternating with 4 scale-like staminodes; styles 2, short: fr. a dehiscent, woody, 2-celled caps., with 2 shining black seeds. The seeds are shot out with considerable force.—Four species, 2 in E. N. Amer. and 2 in China and Japan. Occasionally writers spell the common name "wych hazel," but there seems to be little historical reason for it. Witch, as used in witch-hazel and witch-elm, is probably allied to "weak," referring to a drooping or straggling habit.

The witch-hazels are hardy ornamental shrubs with medium-sized generally ovate or obovate leaves and yellow flowers with strap-shaped spreading petals in axillary clusters appearing late in fall or in the winter and followed by capsular fruits. *Hamamelis virginiana* is perfectly hardy North, and the other species have proved hardy at least at the Arnold Arboretum.

They are valuable on account of their blooming at a time when hardly any other shrub outdoors is in flower. *H. japonica, H. mollis,* and *H. vernalis* are the only truly winter-blooming shrubs in northern latitudes and are striking objects in the wintry landscape with their bright yellow flowers which are not injured even if the temperature goes down to zero. They are well adapted for shrubberies; of compact, bushy habit and with handsome foliage, turning bright yellow, orange or purple in fall.

They thrive best in somewhat moist, peaty and sandy soil. The Japanese species likes a more sunny position than the American, and is less moisture-loving. Propagation is by seeds, which do not germinate until the second year, or by layers; rarer kinds also by grafting on seedlings of *H. virginiana* in spring in the greenhouse.

A. *Lvs. pubescent below while young, glabrescent or glabrous at maturity.*

B. *Fls. in autumn when the lvs. fall; calyx brownish yellow inside.*

virginiàna, Linn. Fig. 1785. Shrub or small tree, attaining 25 ft.: lvs. oblique and cordate at the base, obovate, coarsely crenate, pubescent on the veins beneath, 4–6 in. long: petals bright yellow, ½–¾in. long; calyx dull brownish yellow inside: fr. surrounded by the calyx to one-half. Sept., Oct. Canada to Fla., west to Neb. and Texas. Em. 472. S.S. 5:198. B.M. 6684. L.B.C. 6:598. A.G. 11:657; 17:771; 44:657 (1890). Gn. 33, p. 589; 39, p. 547.

BB. *Fls. in winter or early in spring; calyx red or purple inside.*

vernàlis, Sarg. Shrub, rarely exceeding 6 ft., suckering: lvs. obovate or oblong-obovate, cuneate and entire below, sinuate-dentate above the middle, pale or glaucescent beneath and glabrous or rusty-pubescent on the veins, only 3–4 in. long: calyx dark red inside; petals light yellow, about ⅛in. long; ovary one-half superior: fr. surrounded by the calyx about the middle. Jan.–March. Mo. to La. and Okla. S.T.S. 2:156. R.H. 1913, p, 131. B.M. 8573.

japónica, Sieb. & Zucc. Fig. 1786. Shrub or small tree, to 30 ft.: lvs. roundish to oblong-ovate or obovate, sinuately crenate, prominently veined beneath, glabrous or pubescent, 2–4 in. long: petals ¾in. long, yellow; calyx-lobes revolute, purplish or yellow inside; ovary three-fourths superior: fr. surrounded at the base only by the calyx. Jan.–April. Japan. G.F. 4:257 (adapted in Fig. 1786). Gt. 49:1481; 61, p. 136. G.W. 7, p. 405. S.I.F. 2:25. Var. **arbòrea,** Rehd. (*H. arbòrea,* Mast.). Lvs. larger, usually more roundish and of firmer texture: petals golden yellow; calyx deep purple inside: of more vigorous growth. B.M. 6659. R.H. 1891:472. G.C. II. 1:187; 15:205; III. 9:247. G.M. 34:94. Gn. 57, p. 103; 65, p. 59; 69, p. 105. Var. **Zuccariniàna,** Arb. Kew. Differs little from the type; it has pure canary-yellow fls., smaller than those of the preceding variety and opening about 3 weeks later. Gn. 17, p. 251. R.B. 28:62.

AA. *Lvs. densely tomentose below: calyx brownish purple inside.*

mŏllis, Oliver. Shrub or small tree, to 30 ft.: lvs. orbicular-obovate or obovate-oblong, cuspidate, obliquely cordate at the base, dentate, somewhat rough above, grayish white below, 4–5 in. long: calyx purplish red

1786. Hamamelis japonica. (×⅓)

inside, petals golden yellow, ¾in. long; ovary nearly one-half superior. Jan.–March. Cent. China. B.M. 7884. G.C. III. 52:488. Gn. 75, p. 20. H.I. 18:1742.

ALFRED REHDER.

HAMÈLIA (Henry Louis Duhamel du Monceau, 1700–1782, prominent French botanical author). *Rubiàceæ.* Ornamental woody plants grown chiefly for their handsome scarlet or yellow flowers and for the attractive black or purple berries.

Evergreen shrubs with terete branches: lvs. membranous, opposite or sometimes in whorls, petioled, entire, with interpetiolar stipules: fls. short-stalked or sessile in terminal forking cymes; sepals 5, upright; corolla tubular or bell-shaped, 5-ribbed, contracted at the base, limb with 5 short lobes; stamens 5, with the filaments connate at the base and inserted above the base of the tube; ovary inferior, 5-celled; style slender with spindle-shaped stigma: fr. a small ovoid or globular berry with numerous minute seeds.—About 13 species, by some reduced to 6, in Trop. and Subtrop. Amer.

These are upright shrubs with herbaceous shoots, rather large, generally ovate-oblong acute leaves and yellow or scarlet flowers in terminal clusters followed by small black or purple berries. They can be cultivated outdoors in subtropical and tropical regions only. Propagation is by seeds and by cuttings of half-ripened wood in early summer under glass.

Of the best-known species much prized in Florida and recommended for northern conservatories under the name of "scarlet bush," E. N. Reasoner writes:

"*Hamelia patens,* a native of the West Indies and Southern Florida, along the coast, a beautiful and almost unknown plant, should become a favorite in greenhouse culture. The leaves have a purplish hue at some seasons of the year, and the flowers are of a bright orange-red color. In Florida it must surely become a favorite for open-air planting, as it is there rarely killed down by frost, and when it is it sprouts up readily from the root, and blooms the following summer. It is in bloom for many months, and without doubt could be forced at any season. With age it becomes a woody shrub, 5 to 12 feet in height. The flowers are succeeded by handsome black berries, which are retained a long while."

A. *Plant glabrous or minutely pubescent.*

pàtens, Jacq. Shrub, to 12 ft.: lvs. opposite or usually in whorls of 3, elliptic-ovate to oblong, acute or acuminate at both ends, minutely pubescent or glabrous, 3–6 in. long; petiole ½–1½ in. long: infl. 2–5 in. across; sepals triangular, short; corolla with narrowly cylindric tube about ¾in. long, scarlet-orange: fr. ovoid, black, ¼in. long. Fla. to Brazil. B.M. 2533.

ventricòsa, Swartz. Shrub or small tree: lvs. usually in whorls of 3, rarely 4, oblong-lanceolate, acuminate, glabrous, 3–5 in. long: fls. yellow, about 1½ in. long, tubular-campanulate, constricted above the base in a terminal few-fld. infl.: fr. ovoid. W. Indies. B.M. 1894. B.R. 1195.—The similar *H. chrysántha,* Swartz (L.B.C. 11:1098) has smaller fls. and smaller more obovate lvs.

AA. *Plant hirsute.*

sphærocárpa, Ruiz & Pav. Shrub, to 12 ft.: lvs. usually in whorls of 3, oblong, acute, undulate, hirsute on both sides, 3–4 in. long: fls. in large terminal cymes, orange-yellow, tubular, about 1 in. long: fr. subglobose, hirsute, purplish black. Peru.

ALFRED REHDER.

HAPLOCÁRPHA (probably from Greek for *single chaff,* in reference to the 1-rowed chaffy pappus). *Compósitæ.* Stemless perennials with a woody rhizome: radical lvs. short-petioled, entire or lyrato-pinnatifid, white-tomentose beneath: scapes 1-headed, longer than lvs.: fr. 3–5-ribbed, provided at base with tufts of hairs, naked or hairy above, with a crown of small, pointed pappus-scales.—Four or five species from the Cape region. *H. scapòsa,* Harv., resembles an acaulescent species of Arctotis: lvs. lanceolate to elliptic, 3–9 in. long, green above, white-woolly beneath: peduncles many times longer than lvs., bearing a solitary clear yellow fl.-head, 1½–2½ in. across. G.C. III. 40:124. Sometimes planted in the open, but not hardy N.

L. H. B.

HAPLOPÁPPUS: *Aplopappus.*

HAPLOPHŸLLUM: *Ruta.*

HARDENBÈRGIA (after Franziska, Countess of Hardenberg, sister of Baron Huegel, a well-known traveler.) *Leguminòsæ.* Vines, grown chiefly for their handsome flowers.

Twining herbs or subshrubs: lvs. pinnate with small stipules; lfts. 3 or 5, sometimes reduced to 1, entire, with stipels: fls. papilionaceous, small, on long racemes, ranging from white through pink and rosy purple to violet-blue, often with 1 or 2 green or yellowish spots on the standard; calyx 2-lipped, the upper 2 teeth connate; standard orbicular, with inflexed auricles; keel obtuse, shorter than wings; ovary sessile; style short and thick: pod linear, flat or turgid, with several strophiolate seeds.—Three species in Austral. often referred to Kennedya, which has larger and differently colored fls. solitary or in short racemes, with the keel usually about as long as the wing. The two species in

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cult. are grown abroad under glass by those who are skilled in managing Australian woody plants; they prefer peaty and porous soil, as they are, like most Australian plants, impatient of too much or stagnant moisture. The species first mentioned is cult. outdoors in Calif. These plants can be trained into bush form. Prop. is by seeds or by greenwood cuttings of lateral shoots under glass in spring.

A. *Lfts. solitary: pods flat, with dry pulp inside.*

monophýlla, Benth. (*Kennédya monophýlla,* Vent. *K. longiracemòsa,* Lindl. *K. cordàta,* Lindl. *K. ovàta,* Sims). Lfts. usually reduced to 1, ovate to narrowly lanceolate, rounded or cordate at the base, obtuse, reticulate, 2–3 in. or sometimes 4 in. long: fls. less than ½in. long, in 2's or rarely 3's, as many as 35 in a raceme, and the upper racemes often forming a terminal panicle. B. 2:84. B.M. 263, 2169. L.B.C. 8:758 and 20:1940. B.R. 944; 1336. R.H. 1896, p. 431. R.B. 22:169.—The fls. range from white through rose and purplish to pure violet, but are never distinctly blue. Var. **álba** and var. **rósea** are cult.

AA. *Lfts. 3 or 5: pod turgid, without pith or pulp.*

Comptoniàna, Benth. (*Kennédya Comptoniàna,* Link. *K. macrophýlla,* Lindl.). Lfts. 3 or 5, and in the latter case the lateral ones close together in 2 opposite pairs, not opposite in distant pairs, oval to linear-lanceolate, rounded or truncate at the base, obtuse, 1½–3 in. long, rarely longer: fls. similar to those of the preceding species, but usually blue or violet-blue and in pairs or clusters of 3–4 along the racemes. B.R. 298; 1862; 26:60. R.H. 1882, p. 344. J.H. III. 30:361; 44:253. P.M. 8:27, 267. H.U. 5:236. Var. **álba** is cult.

H. retùsa, Benth., is an anomalous species not cult. All other names in this genus are synonyms of the 2 species described above.

ALFRED REHDER.†

HARDHACK: *Spiræa tomentosa.*

HARDY PLANTS. The word "hardy" covers many distinct ideas. It is used to distinguish plants that can be cultivated outdoors the year round from plants that must be grown under glass part or all of the year. For example, in this Cyclopedia plants are spoken of as hardy as far north as Washington, D. C., New York, Boston or Montreal, meaning that the plants are not killed by the winters at these places. In its widest sense, "hardy" indicates resistance to all kinds of unfavorable conditions. Thus, while all the common geraniums are tender plants, one variety may be hardier than another because it withstands intense heat and drought and general neglect. In general, however, the unqualified word "hardy" indicates that the plant is able to withstand the winter of the given place. See the articles *Border* and *Landscape Gardening.* Smaller divisions of the subject of hardy plants are discussed under *Alpine Plants* and *Aquatics.*

HAREBELL: *Campanula rotundifolia.*

HARICOT (French name for *Phaseolus vulgaris*). Same as kidney bean of the English. It is the common garden bean of America, as distinguished from the Windsor or broad bean, lima bean, and others. See *Bean.*

HARÌNA: *Wallichia.*

HARIÒTA: *Hatiora.*

HARLEQUIN FLOWERS: *Sparaxis.*

HARPÀLIUM: *Helianthus.*

HARPEPHÝLLUM (from the Greek for *sickle* and *leaf,* in reference to the falcate lfts.). *Anacardiàceæ.* KAFIR PLUM. Two species, of which **H. cáffrum,** Bernh., is cult. in Fla. and S. Calif. It is a tall, glabrous tree with hard, heavy wood: lvs. thick, lustrous, imparipinnate, alternate, aggregate at top of branches, stalked; lfts. sessile, falcate-lanceolate: fls. small, in compact axillary panicles, dicœcious; calyx with 5 obovate segms.; petals 5, narrow-ovate, imbricate in the bud; stamens 10 in the male fl., somewhat shorter than the petals, inserted below margin of the disk: fr. obovate, with thick woody endocarp, 4-celled, with 2 small, sterile cells, and 2 large fertile cells, dark red, size and shape of a large olive, the very thin pulp having a subacid taste; edible. S. Afr. L. H. B.

HARRÍSIA (named for William Harris, Superintendent of Public Gardens and Plantations, Jamaica). *Cactàceæ.* Upright tall cacti, little planted.

Stems rather slender, sometimes weak: branches fluted and having 8–11 rounded ribs: areoles bearing slender needle-like spines: fls. tubular, rather large, growing from near the tips of the branches, night-blooming: fr. naked, globose, yellow.—About 8 species known; these confined to the W. Indies.

grácilis, Brit. (*Cèreus repándus* of Cyclo. of Amer. Hort., not *Cáctus repándus,* Linn.). Sts. said to be 20 ft. long: ribs 8–10: spines in clusters of 9–12: fls. white, the bracts on the tube filled with long white hairs.

J. N. ROSE.

HARTWÉGIA (Theodor Hartweg collected in Mex. for the Horticultural Society of London, and found these plants near Vera Cruz). *Orchidàceæ.* Tender epiphytic orchids from Trop. Amer., growing about a foot high and bearing purple fls. The genus has the habit of Epidendrum, section Amphiglottis, but differs in having the labellum saccate at the base, in which respect the genus approaches Ponera; however, Ponera has a very different habit.—Two species. Rest them in a coolhouse Oct. to March. Growing temperature should be 65–90°.

purpùrea, Lindl. Lvs. solitary, leathery, ovate-lanceolate, equally terete with the st., many times shorter than the thread-like peduncle: fls. small, purple; sepals acute, a little larger than the petals; limb of the lip white at the base, callous. Mex.

H. gémma, Reichb. f. "This is a most lovely gem," wrote Reichenbach, and "much better than its predecessor." Gemma, therefore, probably does not mean "twin," in this case. Lvs. solitary, semi-terete, thick, acute, channelled, blotched with blackish violet: fls. amethyst-purple, in a small, 1-branched panicle; odd sepal acute, obtusely strap-shaped, equal sepals oblong-acute. Cent. Amer. L. H. B.

HASTÍNGSIA (S. Clinton Hastings, San Francisco, promoter of Californian botany). *Liliàceæ.* Two bulbous plants of the Pacific slope, separated by Sereno Watson from the genus Schœnolirion (the Oxytria of Rafinesque), offered by collectors but little known in cultivation.

Plants with white or greenish fls. in many-fld. dense panicles or racemes: perianth-segms. distinct, each obscurely 3-nerved; stamens 6; style short; ovary oblong-ovate and not deeply lobed (so differing, among other things, from Schœnolirion, which has a depressed-globose deeply 3-lobed ovary and fr.). Hastingsias have strong, nearly naked sts., arising from a tunicated bulb: lvs. rather fleshy. Treatment as for camassia.

álba, Wats. Mostly stout, 2–3 ft. high: lvs. 1½ in. or less wide: racemes simple or nearly so, 1 ft. long, densely fld., the fls. ¼in. or less long, white or greenish white; stamens equaling the segms. Dry hillsides, N. Calif. northward.

bracteòsa, Wats. Bracts narrow and nearly equaling the fls., which are larger than in the other, and white; stamens half as long as segms.: lvs. narrower. S. Ore., in marshes. L. H. B.

HATIÒRA (an anagram of Hariota). *Cactàceæ.* Upright cacti, allied to Rhipsalis.

Plants erect, branching: branches short, [illegible] in 2's or 3's from tops of older branches, sm[illegible] spineless, bearing several abortive areoles alo[illegible] sides and each a large woolly terminal one from which

arise the fl. and succeeding branches: fls. terminal; ovary globular, naked or nearly so; sepals usually in 2 rows, the outer ones broader and short, the inner ones larger and more petal-like; petals distinct, narrow toward the base; stamens distinct, erect, borne on the disk; stigmas 5, erect, white. Closely related to Rhipsalis, with which as Hariota it is often united, as it was in the Cyclo. of Amer. Hort.—Some 6 or 7 species of Hariota have been described, but most of these are true species of Rhipsalis; 2 were recognized by K. Schumann. The following is in cult. Hariota, DC. (1834) is a homonym of Hariota, Adans. (1763), and hence the name Hatiora has been substituted.

salicornioìdes, Brit. & Rose (*Hariòta salicornioìdes,* DC. *Rhípsalis salicornioìdes,* Haw.). Plant upright, reaching a height of 18 in., richly branched: areoles hardly setulose or lanate: sts. cereiform, with cylindric or oblong-elliptic joints; mature or fruiting branches with verticillate, club- or flask-shaped joints, with slender base, all apparently, as well as the fls. and fr., growing from the tops of joints: fls. yellow, funnelform, ½in. long: berry small, whitish. Brazil. B.M. 2461.

J. N. Rose.

HAW, or HAWTHORN: *Cratægus.* **BLACK HAW:** *Viburnum prunifolium.*

HAWKWEED: *Hieracium.* Various species of Crepis are known as Hawksbeard.

HAWÓRTHIA (A. H. Haworth, an English botanist of the beginning of the last century, who wrote much and well on succulents). *Liliàceæ,* tribe *Aloíneæ.* Acaulescent or shortly caulescent small succulents.

Leaves usually small, crowded on the st. or in mostly somewhat elongated rosettes: fls. white, green or rosy-striped, tubular with somewhat irregular recurving limb and included style and stamens; segms. of perianth 6, oblong, nearly equal; stamens 6, shorter than perianth; ovary sessile, 3-angled: fr. a loculicidally 3-valved caps., bearing many compressed angled seeds. S. Afr. Monograph by Berger in Engler, Das Pflanzenreich, hft. 33, 1908.—Species 60, occurring in S. Afr. They are interesting condensed or cespitose plants with thick and succulent keeled often tuberculate and sometimes toothed lvs., and fls. in simple or panicled racemes.

Cultivation, propagation and decorative uses as for Aloe, under which, with Apicra and Gasteria, the species were formerly placed. See *Aloe* and *Succulents.*

INDEX.

albicans, 13.
altilinea, 22.
arachnoides, 24.
argyrostigma, 11.
aristata, 22.
asperula, 17.
attenuata, 11.
cæspitosa, 8.
clariperla, 11.
coarctata, 6.
concava, 20.
concinna, 1.
corallina, 7.
cuspidata, 23.
cymbiformis, 20.
erecta, 7.
exp[illegible]
f[illegible]
hybrida, 3.
indurata, 1.
inflexa, 14.
lævis, 13.
limpida, 22.
major, 2, 7.
margaritifera, 7.
minima, 7.
minor, 5, 7.
mirabilis, 16.
mucronata, 22.
[illegible]itica, 18.
[illegible]usa, 20.
[illegible]a, 14.
[illegible]ridis, 9.
[illegible]*ylla,* 22.
[illegible]rigida, 2.
[illegible]-tuosa, 1.
[illegible], 10, 12.
ramifera, 13.
recurva, 15.
Reinwardtii, 5, 6.
reticulata, 21.
retusa, 18.
rigida, 4.
rugosa, 9.
semimargaritifera, 7.
subalbicans, 7.
subfasciata, 11.
subrigida, 2.
subulata, 10.
tesselata, 14.
torquata, 1.
tortella, 2.
tortuosa, 2.
turgida, 19.
virescens, 13.
viscosa, 1.

[illegible] *an elongated st.* (*aspect of Apicra*).

[illegible] *lvs. never coarsely white-dotted.*

c. *The lvs. 3-ranked, concave.*

viscòsa, Haw. (*Alòe viscòsa,* Linn. *A. triangulàris,* Lam. *Apìcra viscòsa,* Willd.). St. with lvs. 1¼ x 4–8 in., occasionally forked, clustered: lvs. dull green, ½ x 1 in., appressed with spreading tips, minutely scabrous: infl. 1 ft. high, slender and curving, simple; fls. green-lined. Cape. DC., Pl. Gr. 16. B.M. 814. Salm, Aloe §3, f. 3.—The type, with straight ranks of lvs., varies into a form with larger less-crowded lvs., var. **induràta** (*H. induràta,* Haw., *Alòe induràta,* R. & S., *A. viscòsa induràta,* Salm), Salm, Aloe §3, f. 3*b;* a small form with more spreading lvs. in somewhat spiral ranks, var. **pseudotortuòsa,** Baker (*H. pseudotortuòsa,* Haw., *Alòe pseudotortuòsa,* Salm, *A. subtortuòsa,* R. & S., *Apìcra tortuòsa,* Willd.), Salm, Aloe §3, f. 5; a dwarf form with straight-ranked, longer, more spreading, nearly smooth lvs., var. **concínna,** Baker (*H. concínna,* Haw., *Alòe concínna,* R. & S., *A. viscòsa màjor,* Salm), Salm, Aloe §3, f. 4. Berger 24; and a taller form with more or less spiral ranks of outcurving lvs. 2 in. long, var. **torquàta,** Baker (*H. torquàta,* Haw., *Alòe torquàta,* Salm), Salm, Aloe §3, f. 6.

2. **tortuòsa,** Haw. (*Alòe tortuòsa,* Haw.). St. 4–5 in., more or less clustered: lvs. dull green, ¾ x 1½ in., ascending in 3 irregularly oblique crowded ranks, somewhat rough on the back: infl. about 1 ft. high, slender, occasionally forked; fls. rosy-lined. Cape. Salm, Aloe §4, f. 2. B.M. 1337. Berger 25.—Varies in a form with fleshier lvs., 2 in. long, rough on both faces, var. **pseudorígida,** Berger (*H. subrígida,* Baker, *Alòe pseudorígida,* Salm, *A. subrígida,* R. & S., *Apìcra pseudorígida,* Haw., *Apìcra rígida,* Willd.), Salm,

1787. Haworthia Reinwardtii. (×½)

Aloe §4, f. 1. Jacq. Fragm. 108; a still larger, greener, rougher, and more succulent form, var. **màjor,** Berger (*A. pseudorígida màjor,* Salm), Salm, Aloe §4, f. 2*β*; and a smaller form with the more spirally arranged lvs. smooth above, var. **tortélla,** Baker (*H. tortélla,* Haw.).

cc. *The lvs. more or less irregularly 5-ranked, spreading.*

3. **hýbrida,** Haw. (*Alòe hýbrida,* Salm). St. with lvs. 2½ x 4–5 in., more or less cespitose: lvs. dull green, ¾ x 1½ in., plump, wrinkled above and roughened: infl. 2 ft. high, branched; fls. brown or rosy lined. Cape (?). Salm, Aloe §4, f. 4.—Possibly a hybrid between the preceding and following species.

4. **rígida,** Haw. (*H. expánsa màjor,* Haw. *Alòe rígida,* DC. *A. cylíndrica rígida,* Lam. *Apìcra expánsa,* Willd.). St. with lvs. 4 x 3–5 in., more or less cespitose: lvs. green or browning or rosy-margined, ½–¾ x 2–2½ in., concave, wrinkled beneath: infl. 2 ft. high, more or less branched; fls. striped with brownish green. Cape. Salm, Aloe §4, f. 3. DC., Pl. Gr. 62. Berger 26. L.B.C. 15:1430.—Varies into a smaller form with slightly glossy, smoother, very spreading lvs., var. **expánsa,** Baker (*H.*

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expánsa, Haw., *Alòe expánsa*, Haw. *A. rígida expánsa*, Salm, *Apìcra pátula*, Willd.), Salm, Aloe §4, f. 3*b*.

BB. *Lvs. spirally many-ranked, erect, biconvex, white-warty.*

5. **Reinwárdtii,** Haw. (*H. fasciàta*, Haw. *Alòe Reinwárdtii*, Salm). Fig. 1787. St. with lvs. 1½–2 x 4–6 in., somewhat cespitose: lvs. lanceolate, ½ x 1–1½ in., coarsely white-warty in rows on the back: infl. 1–1½ ft. high, somewhat nodding, simple; fls. lined with rose. Cape. Salm, Aloe §6, f. 16. Berger 27. J.H. III. 59, p. 628.—A smaller form is var. **minor,** Baker.

6. **coarctàta,** Haw. (*Alòe coarctàta*, R. & S. *H. Reinwárdtii víridis*, Hort.). St. with lvs. 3 x 6–8 in., somewhat cespitose: lvs. triangular, ½ x 2 in., sparingly and finely white-dotted in lines beneath: infl. 1 ft. high, nodding, simple; fls. lined with red. Cape. Salm, Aloe §6, f. 17. Berger 27.

AA. *Foliage in a spirally subradical rosette.*

B. *Lvs. not pellucid, dull and firm.*

C. *The lvs. not hard-margined, with prominent white tubercles.*

7. **margaritífera,** Linn. (*H. màjor*, Duval. *Alòe margaritífera*, Mill. *A. pùmila margaritífera*, Linn. *A. margaritífera màjor*, Haw. *Apìcra margaritífera màjor*, Willd.). Somewhat cespitose: lvs. upcurved-spreading, biconvex, ¾–1 x 3 in., with scattered large pearly tubercles often turning green in age: infl. 2 ft. high, branched; fls. sessile, green-lined. Cape. DC., Pl. Gr. 57. Salm, Aloe §6. f. 5. Berger 28.—The type, with green lvs. coarsely warty on both faces, varies into a form with smaller more spreading lvs., var. **granàta** (*H. granàta*, Haw., *H. mínima*, Haw., *Alòe margaritífera mínima*, Ait., *A. granàta*, R. & S., *A. pùmila margaritífera*, Linn., *A. brèvis*, R. & S.), Dill., Eltham. 16, f. 18. Salm, Aloe §6, f. 6; a large form with smaller closer warts, var. **erécta,** Baker (*H. erécta*, Haw., *H. mìnor*, Duval, *Alòe margaritífera mìnor*, Haw., *A. margaritífera mèdia*, Ait., *A. mìnor*, R. & S., *A. erécta*, Salm), Dill., Eltham. 16, f. 17. B.M. 815. Salm, Aloe §6, f. 7; also into forms with little if any roughening on the upper face, var. **semimargaritífera,** Baker (*H. semimargaritífera*, Haw., *Alòe semimargaritífera*, Salm), otherwise resembling the type; var. **corallìna,** Baker, with smaller tubercles; and var. **subálbicans,** Salm, with whitened lvs., Salm, Aloe §6, f. 1.

8. **fasciàta,** Haw. (*Alòe fasciàta*, Salm. *Apìcra fasciàta*, Willd.). Cespitose: lvs. erect, flattened above, ½ x 1–1½ in., somewhat glossy, with the coarse white tubercles in cross-bands: infl. scarcely 1 ft. high, branched; fls. rosy-lined. Cape. Salm, Aloe §6, f. 15. Berger 28.—A supposed hybrid with *H. attenuata*, which it approaches, is var. **cæspitòsa,** Berger.

9. **rugòsa,** Baker (*H. rádula aspérior*, Haw. *Alòe rugòsa*, Salm., *A. rádula mìnor*, Salm). Somewhat clustered: lvs. ascending, long-pointed, flattened above, ¾–1 x 3–4 in., dull green with smaller white tubercles: infl. 2–3 ft. high, branched; fls. rosy with green veins. Cape(?). Salm, Aloe §6, f. 9.—A deeper green form is var. **pervíridis,** Salm.

10. **subulàta,** Baker (*H. rádula lævior*, Haw. *Alòe subulàta*, Salm. *A. rádula màjor*, Salm). Somewhat clustered: lvs. ascending or outcurved at end, long-attenuate, flattened above, ¾–1 x 4–5 in., green with numerous very small white tubercles beneath: infl. 3 ft. high, somewhat secundly branched; fls. green-nerved. Cape(?). Salm, Aloe §6, f. 10.

11. **attenuàta,** Haw. (*Alòe attenuàta*, Haw. *Apìcra attenuàta*, Willd.). Cespitose: lvs. falcately spreading, pointed, biconvex, ½ x 2–3 in., green with the upper face rough with minute often green points and the back with larger white often banded tubercles or ridges: infl. 2 ft. high, somewhat branched; fls. rosy. Cape. Salm, Aloe §6, f. 12. B.M. 1345 (as *A. radula.*).—Varies into a form with smaller more scattered tubercles, var. **argyrostígma,** Berger (*H. subfasciàta argyrostígma*, Baker), and one with larger and more confluent tubercles, var. **claripérla,** Baker (*H. claripérla*, Haw., *Alòe attenuàta claripérla*, Salm), Salm, Aloe §6, f. 12 *β*.

12. **rádula,** Haw. (*H. rádula multipérla*, Haw. *Alòe rádula*, Jacq. *A. rádula mèdia*, Salm. *Apìcra rádula*, Willd.). Cespitose: lvs. upcurved-spreading, very long-acuminate, flattened above, ¾ x 2½–3 in., green, with irregularly crowded minute tubercles on both faces: infl. 1½ ft. high, branched; fls. green- and rosy-lined. Cape. Jacq., Schoenbr. 422. Salm, Aloe §6, f. 8. Berger 28.

CC. *The lvs. with cartilaginous margin and keel not tuberculate.*

13. **álbicans,** Haw. (*H. lævis*, Haw. *H. ramífera*, Haw. *Alòe álbicans*, Haw. *A. marginàta*, Lam. *Apìcra álbicans*, Willd.). Simple: lvs. ascending or outcurved, pungently acute, concavely triquetrous, 1½ x 3–4 in., glossy, pale, neither roughened nor mottled: infl. 1 ft. high, branched; fls. green- and rosy-lined. Cape. B.M. 1452. Salm, Aloe §5, f. 1. Berger 29.—A greenish form, less margined than in the nearly white type, is var **viréscens,** Baker (*H. viréscens*, Haw. *Alòe viréscens*, R. & S.).

BB. *Lvs. thick, watery-pellucid.*

C. *The lvs. rigid, veiny above, scabrous on the back.*

14. **tesselàta,** Haw. (*Alòe tesselàta*, R. & S.). Little clustered: lvs. bristly toothed, spreading, mucronately short-pointed, ¾ x 1½ in., glossy dull green or reddening above, 5-nerved with an open network of veins, the back scabrous with whitish points: infl. 1–1½ ft. high, simple; fls. nerved with green. Cape. Salm, Aloe §8, f. 1.—Two varieties are distinguished: var. **párva,** Baker (*Alòe párva*, R. & S.), smaller, with the broad lvs. 7-nerved. Salm, Aloe §8, f. 12. Berger 31; and var. **infléxa,** Baker, differing from it chiefly in its more concave lvs. with incurved margin.

15. **recúrva,** Haw. (*Alòe recúrva*, Haw. *A. anómala*, Haw. *Apìcra recúrva*, Willd.). Cespitose: lvs. denticulate, recurved, gradually acute, ¾ x 1½ in., olive-green or purplish, 3- or 5-nerved, the back scabrous with green points: infl. 1 ft. high, simple; fls. red-lined. Cape. B.M. 1353. Salm, Aloe §7, f. 3. Berger 31.

CC. *The lvs. softer, scabrous on the back in the first only.*

D. *Upper face of lvs. abruptly truncately spreading.*

16. **mirábilis,** Haw. (*Apìcra mirábilis*, Willd.). Somewhat clustered: lvs. denticulate, erect, the smooth acute tip almost truncately 3-sided, ¾ x 1½ in., light green or the back purplish, 3- or 5-nerved: infl. 1 ft. high, simple; fls. red-keeled. Cape. B.M. 1354. Salm, Aloe §9, f. 1. Berger 32.

17. **aspérula,** Haw. (*Alòe aspérula*, R. & S.). Little clustered: lvs. denticulate, erect, the 7- to 9-nerved tip scabrid above, ¾ x 1½ in., green: infl. 1 ft. high, nodding; fls. rosy-keeled. Cape. Salm, Aloe §9, f. 2.

18. **retûsa,** Haw. (*Alòe retùsa*, Linn. *Apìcra retùsa*, Willd.). Little clustered: lvs. subentire, spreading in age, the 5- to 8-nerved mucronate tip smooth, ¾ x 1½–2 in., light green: infl. 1 ft. high, simple; fls. nearly sessile, green-keeled. Cape. DC., Pl. Gr. 45. B.M. 455. Salm, Aloe §9, f. 3.—With scarcely mucronate less regularly nerved lvs. it is var. **mûtica,** Haw.

19. **túrgida,** Haw. (*Alòe túrgida*, R. & S.). Cespitose: lvs. subentire, ascending, the acute smooth biconvex or 3-sided lvs. truncately spreading, tip 3- to 7-nerved and somewhat dotted, ¼ x ½–¾ in., glossy light green: infl. 8–10 in. high, simple; fls. green-nerved. Cape. Salm, Aloe §9, f. 5. Berger 32.

DD. *Upper face of lvs. obliquely or obscurely if at all subtruncate, not aristate.*

20. **cymbifórmis,** Haw. (*H. concàva*, Haw. *Alòe cymbifórmis*, Haw. *A. cymbæfòlia*, Schrad. *Apìcra cymbæfòlia*, Willd.). Cespitose: lvs. entire, smooth, ascending, oblong, the point often abruptly deciduous, leaving a scar, about 7-nerved with cross-veins, ¾ x 1½ in., pale and glaucescent: infl. 1 ft. high, simple; fls. red-keeled. Cape. Icon. Sel. Horti Thenensis, 105. B.M. 802. Neues Journ. Bot. 2:2. Jacq., Fragm. 112, f. 1. Salm, Aloe §11, f. 1. Berger 33.—A smaller form with blunter more conspicuously lined lvs. 1 in. long is var. **obtûsa,** Baker (*H. obtùsa*, Haw. *Alòe hèbes*, R. & S.).

21. **reticulàta,** Haw. (*Alòe reticulàta*, Haw. *A. arachnoìdes reticulàta*, Ker. *A. herbàcea*, DC. *Apìcra reticulàta*, Willd.). Cespitose: lvs. smooth, finely denticulate, acute, with about 10 connected nerves, ⅜ x 1 in., light green: infl. 1 ft. high; fls. rosy-lined. Cape. Salm, Aloe §10, f. 1. B.M. 1314.

DDD. *Upper face not truncately spreading at end, aristate.*

E. *Shape of lvs. broad, acute, not scabrous, denticulate or ciliate.*

22. **altilínea,** Haw. (*H. mucronàta*, Haw. *H. límpida*, Haw. *H. aristàta*, Haw. *H. polyphýlla*, Baker. *Alòe altilínea*, R. & S.). Cespitose: lvs. upcurved, biconvex, reticulated, ¾ x 2 in., light green: infl. 1 ft. high, simple; fls. green-lined. Cape. Salm. Aloe §11, f. 3.

23. **cuspidàta,** Haw. (*Alòe cuspidàta*, R. & S.). Nearly simple: lvs. ascending, abruptly pale-tipped, turgid, with 3 connected nerves, ½ x 1 in., pale green: infl. 1 ft. high, simple. Cape.

EE. *Shape of lvs. narrow, long-pointed.*

24. **arachnoìdes,** Haw. (*Alòe arachnoìdes*, Ait. *A. pùmila arachnoìdes*, Linn. *Apìcra arachnoìdes*, Willd.). Simple: lvs. upcurved, rather 3-sided, toothed on the keels, with 8 or 9 somewhat connected nerves, ½ x 2–3 in., glaucescent: infl. 1–1½ ft. high, simple; fls. sessile, rosy-lined. Cape. DC., Pl. Gr. 50. B.M. 756. Salm, Aloe §12, f. 2. Jacq., Schoenbr. 421(?).

H. atróvirens, Haw. Leafy st. very short, the rosettes stoloniferous: lvs. 30–40, dense, oblong-lanceolate, ½–¾ in. long, dull green, reddish brown when old, with 3–5 vertical green lines: scape simple, 6 in. S. Afr. B.M. 1361.—*H. Pèarsonii*, C. H. Wright. Stemless: lvs. crowded, ½ x 1¼ in., pale green, with 2 rows of cilia on back, each with bristle on apex: scape 10 in. long. S. Afr.

WILLIAM TRELEASE.

HAWTHORN: *Cratægus.* **Hawthorn, East Indian:** *Raphiolepis.*

HAYLÓCKIA (Matthew Haylock, gardener to Dean Wm. Herbert, the latter authority on amaryllids). *Amaryllidàceæ.* A small bulb, not unlike a crocus in habit, blooming in spring; allied to Zephyranthes.

South American: lvs. linear, all radical: scape very short bearing a solitary fl., with a slender tube 1–1½ in. long and a limb of about equal length; stamens affixed in the throat and shorter than the lobes; ovary 3-celled, with the filiform style included in the perianth-tube and the stigmas short-linear. *H. pusílla*, Herb., the only species, is likely to appear in the American trade. The fl. has a greenish tube, the limb whitish or straw-colored and stained outside with purple, apparently somewhat variable in color (sometimes pale rose): bulb globose, with brown appressed scales: lvs. appearing after the fls., the latter coming in England in July to Sept. and ephemeral. Extra-trop. S. Amer., in the region of Montevideo and Buenos Ayres. B.R. 1371. B.M. 7693. From Zephyranthes it differs in the very short or almost wanting scape, the ovary being practically in the bulb-neck.

L. H. B.

HAZÁRDIA (Barclay Hazard, Californian botanist). *Compósitæ.* Small shrubs, with silvery leaves and peculiar, not pretty, heads of flowers, borne in August. One is suitable for rockeries and bedding out, but there are better woolly-leaved plants in cultivation.

The genus has about 4 speces of stout, tomentose, deciduous subshrubs of Calif., and at least 1 species from the islands off the coast: heads white-tomentose, numerous, in large cymose panicles, which terminate the branches; rays 5–8, neutral, very short, ligulate or irregularly 5-toothed or lobed, pale yellow changing to brownish purple. In 1887, E. L. Greene made this new genus, remarking that it differs from Diplostephium mainly in habit, the paucity, reduced size, and different color of its rays. It also lacks the tuft of hairs characteristic of the style-tips of Corethrogyne.

detónsa, E. L. Greene (*Corethrógyne detónsa*, Greene). Branches very leafy up to the base of the loose panicle: lvs. of firm texture, 2–4 in. long, obovate-oblong, coarsely serrate; upper surface of older lvs. partly divested of the white tomentum which covers all other parts of the plant. G.C. III. 28:470.

N. TAYLOR.†

HAZEL NUT. The nuts of Corylus (which see). In North America, the term is mostly applied to the native species of Corylus, and the word filbert is used more or less indiscriminately for the nuts of the Old World species. (See *Filbert.*) In the present article, the term hazel nut is used generically for the fruits of all the species. Fig. 1788.

The three native hazels, *Corylus americana*, *C. californica* and *C. rostrata*, have been sparingly introduced to cultivation, but have not developed varieties worthy of naming or propagating. The foreign species, *C. Avellana*, *C. pontica* and *C. maxima*, and perhaps others, were introduced along the Atlantic seaboard at an early day and are maintained in gardens throughout the New England and Middle Atlantic States. Efforts to make extensive culture profitable in the eastern United States have hitherto failed, probably from attacks of a fungous disease, *Cryptosporella anomala*, common on *C. americana*, but not specially injurious to that species. It attacks and destroys the young branches, and later the older branches and trunk, without killing the root. Bordeaux mixture has been suggested as a preventive, but recorded successful experiments are lacking. Experimental plantings on the Pacific slope indicate greater success with imported hazels there than in the East, but they have not developed commercial importance.

The requirements of the filbert in America, so far as known, are: moderately rich, well drained soil; absence of *Corylus americana* from vicinity; freedom from mild periods in winter and late frosts in spring. It is specially subject to frost-injury, as both staminate and pistillate catkins develop in fall and quickly swell and open under the influence of mild weather in winter. The staminate catkins commonly bloom first. If they are destroyed by frost, fertilization can be accomplished by suspending branches from other localities, even of other species.

Propagation by seeds is easily done by stratifying in fall and planting in nursery rows in early spring. Seedlings vary exceedingly, and varieties are perpetuated by budding, grafting, suckers or layers, commonly by the last two methods. A considerable supply of well-rooted suckers can be secured from fruiting trees by banking in summer with rich soil or stable manure to promote root-formation. Stools for layering should be heavily manured to force long and slender shoots suitable for bending. These should be staked down in winter or spring and covered with earth. They may be removed to nursery rows or orchard at end of first season.

Planting should be at a distance of 10 to 20 feet in well-prepared soil, in fall or spring. Ground may be cropped with low-growing, cultivated plants while trees are young, but should be maintained in good tilth and fertility.

Pruning is of special importance with this nut. Trees

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are usually headed at height of 1 or 2 feet, though often permitted to take natural form, which is that of a many-stemmed bush, designated a "stool." Trees are classified according to height of clear trunk into "standard," "half-standard," and "dwarf standard." A short trunk, with vaseform head of six or more branches, is preferred. Suckers should be kept down, unless desired for propagation. Both sexes of blossoms are borne on one-year-old lateral twigs or spurs. March or April, after flowers of both sexes have bloomed, is considered best time for pruning, as unnecessary sacrifice of pollen can thus be avoided. Strong shoots should be headed back to promote spur-formation, and old wood that has borne fruit should be removed annually.

The nuts should not be gathered until ripe, a condition indicated by the browning of the edges of the husk. If left until fully ripe, many of the fruits will rattle out and be lost. The highest prices are obtained for freshly gathered nuts in the husks. To prevent husks from molding, they should be well dried or slightly sulfured. Hazelnuts may be held for considerable periods in tight receptacles, as casks or jars by sprinkling salt over them and storing them in a cool, dry place, or in a refrigerated compartment.

Few insects trouble the European hazelnuts in America, the nut-weevil of Europe, *Balaninus nucum*, not having yet been naturalized. *B. nasicus* sometimes does considerable injury to the native species.

Nuts and filberts are terms loosely used abroad, especially in England, to designate certain rather indefinite forms of *Corylus Avellana* and *C. maxima*. In general, such varieties as have husks shorter than their fruits are termed nuts, while such as have husks as long as or longer than their fruits are designated filberts.

But few varieties are known in America, most of the hazels grown being seedlings from imported nuts. Varieties of *Corylus Avellana* and *C. maxima* are not clearly distinguishable, but in general those with husks longer than the nuts are assigned to *C. maxima*, and those with short husks to *C. Avellana*.

Alba (White Filbert).—Regarded in England as one of the best varieties. Can be kept in husk longer than most others because of constricted form of husk. Kernel covered with a white skin. Known as Avelinier Blanche, Wrotham Park, etc. Succeeds in California.

Cosford (Miss Young's, Thin-shelled).—Nut oblong, thin-shelled, of excellent quality; in a hirsute, laciniated husk, about the same length as nut.

Crispa (Cape Nut, Frizzled Filbert).—Nut thin-shelled, somewhat flattened, late; in husks curiously frizzled throughout and wide open at the mouth. Very productive.

Downton Large Square.—Nut very large, semi-square, thick-shelled and well filled, of the highest quality; husk smooth, shorter than nut.

Du Chilly.—A fine, large, compressed-cylindrical variety, with moderately thick shell, and of fine quality. Introduced from France by Felix Gillet, of California. The largest filbert grown in America so far as known.

Grandis (Round Cobnut).—Nut large, short, slightly compressed, of good quality when fresh, with a thick and hard shell; in a short husk, much frizzled and hairy. One of the best varieties; considered the true Barcelona nut of commerce. Also known as Downton, Dwarf Prolific, Great Cob, Pearson's Prolific and Round Cob.

1788. Filberts and hazels.

(Nat. size)

1. American-grown filberts; 2. *Corylus americana*, form with open involucre; 3. *C. americana*, closed involucre; 4. *C. californica;* 5. *C. rostrata.*

Jones.—A short, roundish nut, of medium size and good quality, somewhat grown for several years in central Delaware. Bush hardy and vigorous, producing suckers freely, and thus far free from disease.

Lambert (Lambert's Filbert, Lambert's Nut, Filbert Cob; Kentish Cob, erroneously).—Nut large, oblong, somewhat compressed; shell rather thick; kernel plump and of rich flavor; an excellent keeper. Husk quite smooth, longer than nut and but slightly cut in margin. Tree productive. Considered the best variety grown in England, where it has been known since 1812.

Purple-leaved.—Nut large and of excellent quality; in a husk longer than the fruit. Planted for ornament, and productive of good nuts under proper treatment. The leaves and husks are of a deep purple color, which is retained until frost. The staminate catkins are tender and often injured by frosts in winter, but when supplied with pollen from some more hardy variety it yields large crops.

Red Aveline (Avelineer Rouge, Red Hazel).—Nut large, ovate, thin-shelled, with a smooth, red-skinned kernel, and of sweet nutty flavor. This variety is prized in eastern California as a productive sort of good quality.

Spanish.—Nut very large, oblong, thick-shelled, with a smooth husk longer than the fruit. Sometimes confounded with Grandis.

W. A. TAYLOR.

HEAL-ALL: *Brunella.*

HEART'S EASE: Old English name for pansy, *Viola tricolor.*

HEATH, HEATHER. The common heather of Old World literature is a hardy plant, *Calluna vulgaris;* the greenhouse heaths are from the Cape of Good Hope and Europe, and belong to the genus *Erica*. For St. Dabeoc's heath, see *Dabœcia.*

HEATING: *Greenhouse heating.*

HEBECLÍNIUM: *Eupatorium.*

HEBENSTREÌTIA (named for John Ernst Hebenstreit, 1703–1757, professor of medicine in the University of Leipzig). *Selaginàceæ*. Annual herbs, subshrubs or shrubs, mostly grown in greenhouses: lvs. alternate or opposite often narrow, entire or often dentate: spikes terminal, often dense, short or elongated; fls. sessile, white, yellow or pink; stamens 4 didynamous, included, filaments short; anthers oblong or linear, 1-loculed; ovary 2-loculed: fr. with 2 cells, often one not well developed.—About 30 species, mostly from S. Afr. **H. comòsa,** Hochst., is grown as a half-hardy annual (plant perennial). One to 4 ft. high: lvs. numerous, lanceolate or elliptic-lanceolate, glabrous, ½–2 in. long; spikes elongate, 2–6 in. long, mignonette-like; cor-

olla yellow or white, with an orange-red blotch on the limb; tube slender; lobes oblong, inner pair much narrower and scarcely longer than the outer. B.M. 7895. May be safely sown outdoors in April. Fls. fragrant. L. H. B.

HÉCHTIA (J. G. H. Hecht, who died in 1837). *Bromeliàceæ*. Mexican succulent plants, one species of which is perhaps cult. in a very few fanciers' collections of tender plants for its dense rosettes or recurved spiny lvs., which are purple above from the middle to the tip and silvery beneath. The genus is distinguished by having dicecious fls. The fls. have no decorative value, being ⅛in. across, white, in small sessile, axillary, yellow-bracted heads, borne at intervals of an inch or so on a very slender scape 2 ft. long.—Fifteen species. Give perforated pots and high temperature.

glomeràta, Zucc. (*H. Ghièsbreghtii*, Lem.). Lvs. 10–18 in. long, rigid, leathery, 9–12 lines wide at base, narrowed gradually to the sharp-pointed apex: bracts sheathing, acuminate: corolla 3-lobed nearly to the base; stamens 6; ovary 3-celled. B.M. 5842. I.H. 10:378.—Soil of chopped moss, old manure and charcoal.

argéntea, Baker. Lvs. about 1 ft. long, stiff and spiny, more or less shining silvery: infl. many-fld.; fls. subsessile; petals elliptic, white, concave; style wanting. Habitat doubtful, perhaps Mex.—Well worth growing as a foliage plant in choice collections. L. H. B.

HECKÈRIA (named for a German botanist). *Piperàceæ*. About 8 S. American and 1 Old World woody plants, distinguished in Piper (with which it is often united) by the many more or less umbellate elongated dense spikes, perfect sessile fls., 2–3 stamens, small anthers with confluent 2-valved cells, obtuse ovary, 3 stigmas: lvs. large, sometimes peltate. *H. umbellàta*, Kunth (*Pìper umbellàtum*, Linn. *Pothomórphe umbellàta*, Miq.), is probably not now in the trade. It is a shrub with roundish-reniform not peltate 11–13-nerved petioled lvs., and 4–7 spikes in an umbel; it occurs from Cuba to Brazil. G.W. 9, p. 445. L. H. B.

HEDEÒMA (Greek, *sweet smell*). *Labiàtæ*. American Pennyroyal. Small aromatic annuals, not of horticultural importance.

Leaves opposite, small: fls. very small, blue or purple, in loose clusters in the axils, the clusters becoming terminal; calyx tubular or ovoid, 13-nerved, the mouth contracted in fr.; corolla 2-lipped, the upper lip erect and entire or lobed; perfect stamens 2, ascending under the upper lip; staminodia 2 or 0.—The genus has about 16 species, all American. The pennyroyal of the Old World is *Mentha Pulegium*, sometimes cult. for its lvs. and tops, which are used as culinary herbs.

pulegioìdes, Pers. American Pennyroyal. Annual, 6–18 in, high: st. very slender, much branched, pubescent: lvs. opposite, ovate to oblong-obovate, sparingly serrate in the upper portion, mostly obtuse at the apex and narrowed at the base, ½–1½ in. long: fls. in axillary clusters; corolla purple, 2-lipped, the lower one with 3 large lobes. July–Sept. B.B. 3:106.—This is of no ornamental value, but the seeds are offered by dealers to those who desire to cult. the plant for its medicinal oil, which is sold in drugstores. It is said to be offensive to mosquitos. The plant can be easily naturalized in dry, sandy spots. It is common in woods and along roads. L. H. B.

HÉDERA (ancient Latin name of the ivy). *Araliàceæ*. Ivy. Ornamental woody root-climbing vines grown for their handsome persistent foliage.

Evergreen shrubs, climbing by aërial rootlets: lvs. alternate, long-petioled, entire or coarsely dentate or 3–7-lobed: fls. perfect, pedicelled, in umbels arranged in terminal racemes or panicles; calyx 5-toothed; petals and stamens 5; ovary 5-celled; style short, cylindric: fr. a 3–5-seeded berry.—Five species (or 6, if *H. helix chrysocarpa* is considered a distinct species) in Eu., N. Afr. and from W. Asia through Cent. Asia to Japan. Monograph by Fr. Tobler, Die Gattung Hedera (1912); a good popular monograph is Shirley Hibberd's "The Ivy: A monograph, comprising the history, uses, characteristics, and affinities of the plant, and a descriptive list of all the garden ivies in cultivation." London, 1872. Many araliads have been described formerly as species of Hedera which are now referred to other genera.

The ivies are climbing shrubs, with inconspicuous greenish flowers appearing in fall, and black, rarely yellow, red or whitish berries ripening the following spring. *Hedera helix* is hardy in sheltered places as far north as Massachusetts; at the Arnold Arboretum a form introduced from the Baltic provinces, Russia, under the name *H. helix baltica* has proved hardier than any other form. All other species, also most of the variegated forms of *H. helix* and its var. *hibernica*, are tender, but the Japanese species has not yet been sufficiently tested.

The ivy is a very valuable plant for covering walls, rocks, trunks of trees and trellis-work, and sometimes climbs very high. It may also be used for covering walls in cool greenhouses, for screens in drawing-rooms and for hanging-baskets. It is a popular window-garden plant, enduring many uncongenial conditions and thriving without bright sunlight. In shady places under trees it makes a handsome evergreen carpet, and is also often used for borders of shrubberies or flower-beds.

It grows in almost any soil, but best in a somewhat moist and rich one, and in shaded positions. The climbing or creeping branches do not flower; flowers are produced on erect, bushy branches, appearing on old, high-climbing plants only. Propagation is by cuttings of half-ripened wood at any time of the year in the greenhouse or in frames, or, in more temperate regions, in the open ground in fall; gentle bottom heat will hasten the development of roots considerably; also increased by layers and by seeds which must be sown soon after ripening and germinate slowly, usually not until the second year. The slow-growing forms, especially the shrubby ones, are often grafted on cuttings of strong-growing varieties, as they do not grow readily from cuttings.

A. *Pubescence of the infl. and the young growth grayish, stellate.*

hèlix, Linn. Ivy. English Ivy. Fig. 1789. High climbing or creeping: lvs. usually 3–5-lobed, dark green above, pale or yellowish green beneath,—those of the flowering branches entire, generally ovate: calyx with minute teeth; calyx, pedicels and tips of young branches covered with grayish white stellate hairs with 5 or 6 rays: fr. black, sometimes yellow. Eu., Canaries, N. Afr., Asia.—A very variable species, of which more than 60 varieties are cult. in European gardens. The first 3 varieties enumerated below are geographical varieties found growing wild, while the others are merely horticultural forms of garden origin. Var. **hibérnica,** Kirchn. (var. *scòtica*, Hort., var. *irlándica*, Hort.). Lvs. larger and broader, of lighter color and thinner texture, with short and broad lobes, often subcordate at the base: umbels and frs. larger; stellate hairs more often with 8 or occasionally 12 rays. Ireland. Var. **chrysocárpa,** Tenore (*H. poetàrum*, Bertol. *H. chrysocárpa*, Walsh). Lvs. less deeply lobed, bright or yellowish green, often undulate, those of the flowering branches narrower: fr. yellow. Turkey, Greece, Asia Minor. Var. **taùrica,** Rehd. (*H. poetàrum* var. *taùrica*, Tobler. *H. taùrica*, Hort.). Lvs. narrower, usually undulate, bright green, those of the sterile shoots usually sagittate, with elon-

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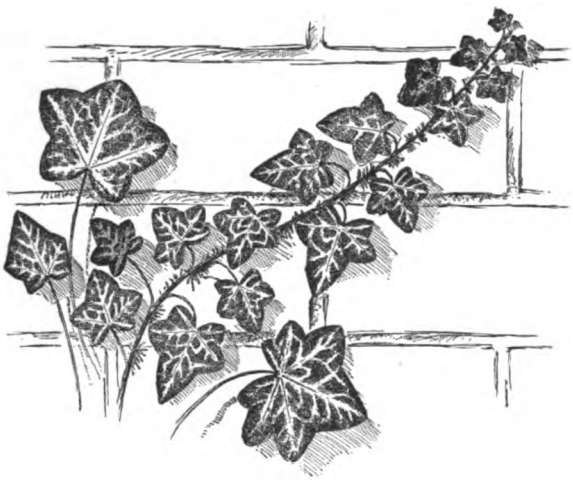
gated middle lobe and 1 or 2 short spreading lobes on each side at the base: rather more pubescent, stellate hairs with about 8 rays. Crimea. Possibly hybrid of *H. helix* and *H. colchica*.—The following are some of the most remarkable of the horticultural forms: Var. **arboréscens,** Loud. (*H. arbòrea*, Hort.). Not climbing, forming an erect, low shrub: lvs. ovate to elliptic, entire. This variety is gained by using flowering branches for prop. There are also some variegated forms, as Silver Queen, with silvery variegated lvs. Var. **bàltica,** Hort. A small-leaved form hardly differing from the type; the hardiest or one of the hardiest of the forms in cult. Var. **Cávendishii,** Koch (var. *marginàta mìnor*, Hort.). Slow-growing, with rather small dull green lvs., edged creamy white, striped red or pink in fall. Var. **conglomeràta,** Nichols. Slow-growing: lvs. crowded, small, entire or 3-lobed, undulate. R.H. 1890, p. 163. Var. **crenàta,** Hibberd (*H. vitifòlia* and *H. digitàta nòva*, Hort.). Similar to var. *digitata*, but lobes shorter and broader, crenate at the



1789. Hedera helix. Form with white-ribbed leaves. (×⅓)

margin, light green. Var. **deltoídea,** Hibberd (var. *hastàta*, Hort.). Lvs. rather small, bluntly deltoid, almost entire, blackish green, changing to dull purplish bronze in fall. Gn. 25, p. 141; 34, p. 493 (as *A. hastata*). Var. **digitàta,** Loud. Lvs. rather large and broad, digitately lobed with 5 triangular-oblong lobes, sometimes with 2 small additional basal lobes, truncate at the base, dark green. Gn. 25, p. 141; 34, p. 493. Var. **grácilis,** Hibberd. Lvs. rather small, with broad, short lobes, dull green, bronzy in fall. Gn. 59, p. 154. Var. **lobàta màjor,** Hibberd. Similar to var. *hibernica*, but lvs. somewhat smaller, more deeply lobed and lobes narrower. Var. **lùcida,** Hibberd. A form of var. *chrysocarpa*, with large deltoid lvs. not lobed or partly or slightly 3–5-lobed, glossy above: a vigorous grower. Gn. 25, p. 141; 34, p. 492. Var. **lusitánica,** Hesse. Similar to var. *palmata*. Lvs. large, to 5 in. across, light green, palmately 5-lobed with triangular lobes. Var. **maculàta,** Hort. (*H. latifòlia maculàta*, Hort.). Similar to var. *hibernica:* lvs. spotted and striped yellowish white. Var. **marginàta,** Hort. Lvs. broadly triangular-ovate, irregularly bordered yellowish white, striped red or pink in fall: of somewhat slow growth. F.E. 31:318. Var. **marmoràta,** Hort. Similar to var. *hibernica*, but lvs. irregularly blotched yellowish white. Var. **mínima,** Hibberd (var. *donerailénsis*, Hort.). Lvs. small, 3-lobed or pedately 5-lobed, with short and spreading basal lobes, dull purplish brown in winter. Gn. 59, p. 154. M.D.G. 1897:229 and S.H. 2:237 (as var. *digitata*). Var. **palmàta,** Hort. Similar to var. *digitata*, but lvs. 3–5-lobed with broader distinctly triangular lobes, the lateral ones more spreading, dull green. Var. **pedàta,** Hibberd. Lvs. pedately 5-lobed, the middle lobe long and narrow, the lateral lobes much shorter, dark green with whitish veins. Gn. 25, p. 141; 34, p. 493; 59, p. 154. Var. **sagittifòlia,** Koch. Lvs. rather small, with triangular middle lobe and short, broad and obtusish lateral lobes, deeply cordate at the base, dull dark green. Var. **tesselàta,** Nichols. Lvs. 3-lobed with short and broad lobes, with a distinct reticulate variegation. J.H. III. 28:209; 45:99. Var. **tortuòsa,** Hibberd. Lvs. ovate or rhombic, entire or obscurely 3-lobed, more or less curled and twisted, the curling increasing during cold weather. Gn. 55, p. 336. Var. **trícolor,** Hibberd (var. *marginàta rùbra*, Hort., var. *elegantíssima*, Hort., var. *Cúllisii*, Hort.). Like var. *marginata*, but edges of lvs. becoming red in fall.

canariénsis, Willd. (*H. hèlix* var. *canariénsis*, DC. *H. algeriénsis*, Hort. *H. maderénsis*, Hort. *H. azòrica*, Hort.). High-climbing: pubescence more scaly, hairs with 12–20 rays: lvs. large, bright green, roundish ovate, usually cordate at the base, entire or with 3–7 rather short lobes of almost equal size: umbels larger, often solitary or few; calyx-lobes broader: frs. black, sometimes ½in. thick. Canary Isls., Madeira, N. Afr. Gn. 25, p. 141; 34, pp. 492, 496. G.M. 54:319. Var. **arboréscens,** Koch. Not climbing, forming an upright low shrub. G.M. 54:957. Var. **variegàta,** Hort. (*H. maderénsis variegàta*, Hort.). Lvs. entire or slightly 3-lobed, edged yellowish white. G.C. II. 15:657. G.M. 54:320.

aa. *Pubescence scaly, golden yellow.*

cólchica, Koch (*H. Rægneriàna*, Hort. *H. coriàcea*, Hibberd). High-climbing: lvs. large, broadly ovate, cordate, almost entire, rarely slightly 3-lobed, bright green, of firm texture, those of flowering branches generally oblong-ovate: calyx-lobes triangular-ovate, conspicuous; calyx, pedicels and tips of young branches coated with golden yellow scales with about 20 or 25 rays: fr. black. Asia Minor, Caucasus, Persia. Gn. 25, p. 141; 34, p. 492. Gt. 11:360. Var. **dentàta,** Hibberd (*H. dentàta*, Hort.). Lvs. with remote small teeth, of somewhat thinner texture. G.M. 30:388; 54:318. Gn. 36, p. 7. Var. **purpùrea,** Hibberd. Lvs. purplish. Var. **arboréscens,** Koch. Not climbing, of upright shrubby habit. Gn. W. 20:467.

H. glomerulàta, DC., belongs to the genus Brassaiopsis and its correct name is B. glomerulata, Regel (B. speciosa, Decne. & Planch.). A glabrous tree, with large digitate lvs.; lfts. 5–7, oblong-lanceolate, stalked: fls. in long pendulous panicles consisting of long-stalked globular heads of small fls. S. Asia. B.M. 4804. Gt. 12:411. G.M. 32:367.—*H. himalàica*, Tobler (H. helix aurantisaca, André). High-climbing: pubescence scaly, gray or yellowish, the scales with many rays: lvs. of the sterile branches pinnately lobed with 2–5 lobes or teeth on each side, those of the flowering branches oblong-ovate to oblong-lanceolate, cuneate at the base: fr. yellow. Himalayas. R.H. 1884:84. Var. *sinénsis*, Tobler. Lvs. of sterile shoots entire or 3-lobed, of fertile branches elliptic or elliptic-oblong. W. China.—*H. japónica*, Tobler (H. helix var. rhombea, Sieb. & Zucc.). Not high-climbing: scales of pubescence with many rays: lvs. elliptic-ovate to rhombic-ovate, those of the sterile shoots 3- or rarely 5-lobed, with broad middle lobe and small lateral lobes: fr. black, about ½in. or less across. Japan, Korea.

ALFRED REHDER.

HEDGES. Living green fences are used for two distinct purposes—defense and ornament. Ornamental hedges may be rendered defensive by stretching tightly two or three strands of barbed wire through the center of the hedge. So far, no plant has yet been tested that meets all the requirements of the farmer for a truly impassable barrier, although the Osage orange (*Maclura pomifera*) possesses more recommendable features than any other hardy tree. This tree, however, is not hardy in the northernmost states. For regions south of Washington, D. C., Kentucky, and Missouri, *Poncirus* (or *Citrus*) *trifoliata* is of equal value. Both have the serious drawback of being subject to the attacks of the San José scale, but no satisfactory substitute has yet been found.

Next to these, perhaps, ranks the honey locust

(*Gleditsia triacanthos*), with many warm admirers and advocates. The hawthorn of Europe (*Cratægus Oxyacantha*) may not be planted in this country with much chance of success, owing to fungous enemies.

Cratægus Crus-galli is fairly satisfactory, but is not likely to make a tight hedge close to the ground. Other large thorny shrubs also fail in important particulars.

A perfect thorn hedge requires unremitting care, and must conform to an established rule, the most important being entire freedom from weeds and a systematic pruning. The preparation of the soil for a hedge consists of thoroughly plowing and cultivating an area 6 feet wide and the length the hedge is proposed to extend; or else to dig a trench 2 feet deep and 2 or 3 feet wide, and fill it with good top-soil thoroughly enriched. If this space should be fertilized and cropped the year previous growth will be greatly accelerated.

Deciduous plants must have the tops well shortened, and the root-tips of all plants should be given a clean cut, as they are planted. The plants should be set in a single row as close together as they can be set. For hedges a foot high or less, the plants should not be over 4 inches apart. For hedges 3 or 4 feet high, the plants should be 6 inches to a foot apart.

The double row, as formerly advised by some growers, is now practically obsolete and justly so, being difficult to cultivate and preserve free from weeds. The single row gives the plants a chance to be somewhat balanced, as the two opposite sides will have nearly equal freedom to develop.

A trench or furrow is opened through the center of the cultivated strip of a sufficient depth to admit the roots without bending. In setting, the soil must be made firm with the aid of a rammer, a practice unexcelled for aiding growth, and, indeed, preserving plant-life after removal. Pruning is simply an annual necessity from the first, excepting when the hedge is intended to be plashed, and even in such cases, after the laying process, pruning must never be omitted during summer. This work is greatly accelerated and consequently cheapened by shearing when the plants are young and tender, say during the month of July.

As to the best outline, a plain triangle, or what may be more sightly, the curvilinear or Gothic arch, is desirable, and a flat top is to be discouraged, as a body of snow lodged on it invariably injures the symmetry and beauty of any hedge. Another advantage of the triangular and Gothic arch types is that the sun can better reach the bottom of such hedges and keep them covered with foliage down to the ground. A rectangular hedge is liable to have bare spots at the base, while a hedge wider at the middle or top than at the bottom, is almost sure to be without foliage near the ground

Material available for defensive hedges has already been discussed. For ornamental hedges, there are a large number of plants available, both deciduous and evergreen. Of these the half-evergreen California privet (*Ligustrum ovalifolium*) is probably more largely used than anything else, and in the eastern United States possibly more largely used than all other material combined. Its advantage over its competitors is its low first cost, and its responsiveness to pruning and training. These are offset by its liability to kill to the ground every few years, even toward the South. Probably the best hedge plant, all things considered, is Thunberg's barberry (*Berberis Thunbergii*).

Of the evergreen hedges, the arbor-vitæ (*Thuya occidentalis*) is one of the most widely adaptable and deservedly popular. Hemlock (*Tsuga canadensis*) makes one of the handsomest but it succeeds in a comparatively restricted area. Its reputation as a slow grower should not prevent the box being more largely planted than it is. The Monterey cypress is much used as a hedge in California (Fig. 1790). There are many other evergreens that may be used to advantage.

Among the deciduous flowering plants are a great many that are desirable. A discussion of a few of these is included in the list that follows.

Where room at all permits, mass plantings or even untrimmed tree rows are better than a high hedge for barriers and screens. Plants with variegated or unusually colored foliage should be avoided for hedges.

The most serious annoyance to the hedge-grower is the presence of unwelcome woody vines, such as poison ivy (*Rhus Toxicodendron*), Japan evergreen honeysuckle (*Lonicera japonica*), and so on, and the only remedy is persistently to remove them by hand as soon as discovered. The attacks of insects may be treated similarly to those which injure other trees and shrubs.

Material especially adaptable for hedges.

Abelia grandiflora. Broad-leaved evergreen. Suitable for hedges up to 4 feet. Not hardy north of Washington and St. Louis.

Acer campestre. Deciduous. Adapted for hedges from 4 to 10 feet high in the northern half of the United States.

Azalea (*Rhododendron*) *amœna.* Evergreen. Good for hedges up to 2 feet. Good as far north as New York, Philadelphia, Cincinnati, and St. Louis. Attractive foliage and showy flowers.

Berberis Thunbergii. Deciduous, thorny, slow-growing. Cannot be relied on for hedges over 4 feet high. Adapted to all sections of the United States, except the non-irrigated arid regions. Responds to pruning, but makes a more attractive hedge when shears are not used. Naturally makes a tight bottom. Foliage small and most attractive. Bears annual crops of scarlet berries that hang on all winter, even in the South. Will grow within reach of salt-water spray. The best of the deciduous ornamental hedge plants, and has no superior in any class.

Berberis vulgaris. Deciduous, thorny. Useful for hedges from 3 to 6 feet high. Adapted to the northern half of the United States. Not so tight and compact as the foregoing. Bears berries that hang on half the winter. There is also a purple-leaved variety.

Buxus sempervirens (boxwood; tree box). The box of colonial gardens. Evergreen; slow-growing; adapted for hedges up to 20 feet. Thrives as far north as central New York, southern Ohio, and Missouri. Stands shearing well. Probably the best evergreen hedge-plant in the regions in which it grows.

Buxus suffruticosa (dwarf box). Evergreen. Suitable for use where a small hedge of the last-mentioned could be used.

Carpinus caroliniana (hornbeam). Deciduous. Good for hedges up to 10 feet. Makes a dense, strong hedge. Suitable for use as far south as Virginia and Kentucky.

Carpinus Betulus. Same adaptabilities as the last.

Chænomeles japonica (Japonica; Japan quince). Deciduous; somewhat spiny. Grows North and South and even in comparatively dry regions. Boy- and dog-proof, with handsome flowers. Somewhat subject to San José scale. Excellent.

Cinnamomum Camphora (camphor tree). Broad-leaved evergreen for high or low hedges. Hardy only near the coast from Charleston, South Carolina to Texas.

Cratægus Crus-galli (cockspur thorn). Deciduous. Has long spines. Can be used all over the country, except in the arid regions, but it is best adapted to the North. Flowers and fruits both attractive. Needs careful pruning when young to keep sides clothed to the ground.

Cratægus Oxyacantha. Similar to above. Not quite so dense a grower, but rather more showy flowers and fruits.

Deutzias. Deciduous, flowering shrubs of various heights from 30 inches to 6 feet, making rather loose

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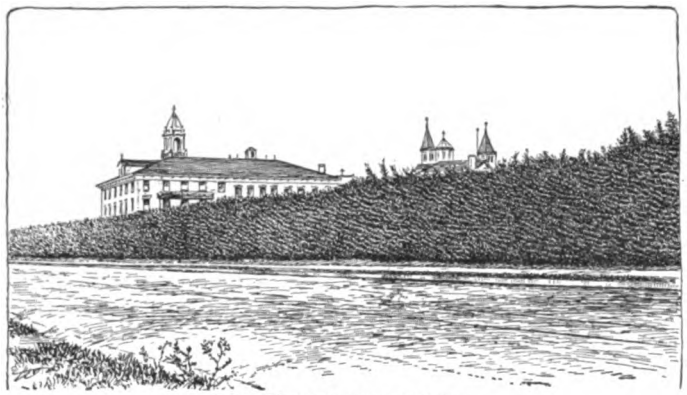
hedges. Especially handsome when in flower. Some varieties hardy as far north as Chicago and northern New York; others only as far as St. Louis and New York City.

Elæagnus angustifolia. Deciduous. Adapted for hedges or low windbreaks to a height of 20 feet. Thrives in all parts of the United States. One of the best for the semi-arid regions. Summer fruits attractive.



1790. Monterey cypress hedge.

Elæagnus parvifolia. Deciduous. Similar to the preceding, but not so widely adaptable.

Evonymus japonica. Broad-leaved evergreen. Useful for hedges up to 3 or 4 feet at its northern limits and double that height in the South. Occasionally winterkills as far north as Philadelphia and Cincinnati but well adapted for regions farther south. There is a variety with yellow-edged leaves.

Fagus sylvatica (beech). Deciduous. Suitable for high hedges or screens. Thrives in the northern half of the country.

Gardenia jasminoides (Cape jessamine). Evergreen. Flowering. Used for hedges up to 5 feet. Hardy in South Carolina, Georgia and the states bordering on the Gulf of Mexico.

Gleditsia triacanthos (honey locust). Deciduous. Thorny. A good defensive hedge; succeeds over the whole United States. Especially valuable in the semi-arid regions and beyond the northern limits of the Osage orange (*Maclura maculata*).

Hibiscus syriacus (rose of Sharon). Deciduous. Flowering. Useful for hedges and screens under 10 feet where an open bottom is not objectionable. Will grow successfully except in the most northern tier of states. Transplant only in spring where the ground freezes in winter.

Ilex Aquifolium (English holly). Broad-leaved evergreen with spiny leaves. Useful for hedges from 2 to 6 feet. Desirable south of Philadelphia and St. Louis. There are many varieties. Handsome.

Ilex crenata (Japanese holly). Broad-leaved evergreen. Leaves smaller than either the preceding or following species and without spines on the leaves. Good for hedges not exceeding 4 feet. Hardy except in the extreme northern states.

Ilex opaca (American holly). Broad-leaved evergreen with spiny leaves. Useful for hedges and screens up to 30 feet. Native near the coast from New Jersey southward and along the Gulf of Mexico. Will grow inland on light soils and thrives on poor ground. Pistillate plants filled with scarlet berries all winter.

Juniperus virginiana (red cedar). Coniferous evergreen. Adapted for hedges and screens up to 30 feet. Thrives almost everywhere. There are several forms in cultivation, but the type is most suitable for hedges.

Ligustrum amurense (Amoor River privet). Broad-leaved evergreen. Leaves smaller than *L. japonica* or *L. ovalifolium*. Better for hedges than *L. ovalifolium*. Hardy as far north as Virginia and Missouri.

Ligustrum Ibota. Deciduous. Adapted to hedges 10 feet and under. Hardy except in the most northern sections. Var. *Regelianum.* Dwarf. Makes hedges 4 feet and under. Filled with blue berries all winter.

Ligustrum japonicum. Broad-leaved evergreen. Useful for hedges up to 6 feet. Not reliably hardy as far north as Washington, D. C., and St. Louis.

Ligustrum ovalifolium (California privet). Broad-leaved half-evergreen shrub. Useful for hedges from 6 inches to 12 feet. Tops liable to freeze to the ground every few years as far south as North Carolina and Oklahoma. Rapid grower. Stands pruning well and needs it frequently. Ranks with dwarf box as a low edging for flower-beds, except it requires weekly or fortnightly pruning. Its low first cost has led to its use in many places where other plants would have been more attractive and more economical. Thrives near salt-water, even within reach of the spray.

Maclura pomifera (Osage orange). Deciduous. A defensive hedge. Hardy as far north as central New York and Nebraska. Subject to attacks of San José scale.

Osmanthus (*Olea*) *fragrans* (sweet olive). Broad-leaved evergreen, bearing sweet-scented flowers. Adapted to low hedges in the Gulf states and as far north as Wilmington, North Carolina, on the Atlantic coast.

Osmanthus Aquifolium. Broad-leaved evergreen. Much like *Ilex Aquifolium* in general appearance, but blooms in late summer. Has showy winter berries on pistillate plants. Sometimes winterkills as far north as Washington, D. C., and St. Louis.

Picea alba (white spruce). Coniferous evergreen. Formal in habit. Good for high hedges and screens. More pleasing in color than the next species. Good for the northern half of the country even in comparatively dry regions.

Picea excelsa (Norway spruce). Coniferous evergreen. Same adaptability as the last and more used than it, but not so desirable.

Pittosporum Tobira. Broad-leaved evergreen. Thrives in the South Atlantic and Gulf states.

Poncirus trifoliata (hardy orange). Almost evergreen South; deciduous in its northern range. Spiny. Good for defensive hedges from 3 to 10 feet high. Large glossy foliage. Attractive. Succeeds as far north as Philadelphia and Cincinnati. Subject to San José scale.

Populus nigra var. *fastigiata* (Lombardy poplar). Deciduous. Adapted for hedges and screens up to 30 feet. Useful in the northern half of the United States.

Prunus caroliniana (mock orange of the South). Broad-leaved evergreen adapted to the southern states from Norfolk south. Excellent.

Retinosporas. Coniferous evergreens adapted to hedges under 6 feet. Suitable for use south of the 40th parallel and in special localities north of it. Not suitable for the semi-arid regions.

Rhamnus cathartica. Deciduous. Good for hedges to 6 feet. Most useful in the northern half of the country.

Rosa rubiginosa (sweetbriar rose). Deciduous, thorny. Adapted for hedges up to 3½ feet. Thrives everywhere except in the most arid sections. It bears attractive flowers and hips, but does not make so close a hedge as many other plants.

Rosa rugosa. Deciduous, thorny. Adapted for hedges of 5 feet and under. Will grow both North and South and is promising for use in the semi-arid regions. Flowers and hips both attractive. For a summer hedge it is excellent, but its winter appearance is not hedge-like although quite effective as a deterrent to intruders.

Spiræas. Deciduous shrubs. A group of beautiful flowering shrubs adapted for use as low hedges North and South and promising for use in the semi-arid regions. *Spiræa Bumalda* var. *Anthony Waterer* would make a hedge 2 feet high with flat-topped pink blossoms in early summer. *Spiræa Thunbergii* grows 5 feet high with white flowers in early spring. It has fine foliage, but the tips of the branches are apt to winterkill even as far south as Virginia and Missouri. *Spiræa Van Houttei* is white, about intermediate between the other two in season. The finest of the spireas in flower. It has beautiful foliage and is adapted for hedges.

Syringas (lilacs). Deciduous shrubs. A group of beautiful flowering shrubs adapted to all parts of the United States, some species being especially promising for the semi-arid regions. *Syringa amurensis* is especially well adapted for use on the Great Plains. It grows 10 feet high. *Syringa persica* is about as adaptable as the last but more dwarf, growing but 5 feet high. *Syringa vulgaris* has many named varieties, both double and single, in a wide range of colors and habit of growth.

Thea Bohea (Chinese tea plant). Broad-leaved evergreen. Low-growing. Blooms in winter. Useful near the seacoast from Charleston, South Carolina, to Texas.

Thuya occidentalis (arbor-vitæ). A coniferous evergreen with many forms, of which the type is as useful as any for hedge purposes. Adapted to all sections of the United States. Much used and deservedly so.

Thuya orientalis (Chinese arbor-vitæ; Biota). Coniferous evergreen with many forms. Useful over nearly the same range as the foregoing.

Tsuga canadensis (hemlock). Coniferous evergreen. Useful for low and high hedges and screens to 50 feet. Adapted to moist and medium soils in the northern half of the United States. One of the handsomest in the regions in which it thrives.

Viburnums. Deciduous and evergreen shrubs. Many-berried and handsome. Among the desirable deciduous species that thrive all over the United States except in the extreme South and the drier regions are *V. cassinoides, V. dentatum, V. nudum, V. Opulus, V. plicatum,* and *V. prunifolium.* The handsome evergreen species *V. Tinus* is tender and not likely to succeed north of the Carolinas and the Gulf States, but where it succeeds it is most desirable. F. L. MULFORD.

HEDRÆÁNTHUS, HEDRÁNTHUS: *Wahlenbergia.*

HEDÝCHIUM (Greek, *sweet snow;* the large white flowers are sweet-scented). *Zingiberàceæ.* BUTTERFLY LILY. GINGER LILY. GARLAND FLOWER. Leafy, rhizomatous herbs allied to Kæmpferia and ginger, grown under glass and in the open far South.

Flowers in a terminal spike or thyrse; calyx tubular, more or less 3-lobed at the summit; corolla-tube slender, scarcely longer than the calyx, all half concealed by the usually showy bracts; upper corolla-segm. often enlarged and lip-like; stamen 1, with a 2-loculed anther surrounding the style; staminodia always present, usually well developed.—Thirty-eight tropical species, Asian and one Madagascar. From the ginger Hedychium differs in having broad, almost petal-like staminodia, which in Zingiber is minute or lacking. The best botanical account is by K. Schumann in Engler's Pflanzenreich, hft. 20 (1904).

Hedychiums are strong-growing plants, very ornamental, both in foliage and in flower. They are essentially fall bloomers, although they may be made to bloom more or less continuously under glass. After blooming, gradually dry off the rhizomes, and let them rest for a time. Pot them up in spring or early summer, and give them rich soil and plenty of water and an occasional supply of liquid manure. The rhizomes may be divided every two or three years. They need an abundance of water. In fact, the pots may be set half their depth in water, and *H. coronarium* is often immersed until only the crown is emersed. The common white-flowered species is *H. coronarium.* This requires warmhouse treatment for best results, although it often flowers well when plunged in a warm, half-shady place in the open. The species do not stand frost, but they may be left out in the South if well protected. The flowers are very fragrant; in fact, their odor may be too heavy for a small room.

A. *Fls. white.*

coronàrium, Koenig. Three to 6 ft.: lvs. canna-like, green, pointed, smooth above, hairy beneath: fls. very large (3–4 in. across), long-tubed, pure white or the lip sometimes blotched green, the 3 outer segms. narrow, the lip large and erect and more or less lobed. Trop. Asia, and naturalized in some parts of Trop. Amer. B.M. 708. L.B.C. 6:507.—Handsome and worthy. Needs warm quarters. Said to have been sold as *Myrosma carnæfolia,* but that name belongs to a wholly different plant.

thyrsifórme, Hamilton. Usually 5 ft. tall: lf. sometimes 1 ft. long and 3–4 in. wide, finely hairy and pale beneath: spike very dense, the lower empty bracts ovate, the upper and fl.-bearing cylindric, green, about 1½ in.; corolla-tube not much longer than the bract, its segms. linear, white; lip distinctly clawed. Trop. Himalaya. B.R. 767 (as *H. heteromallum*).—Not much known, but advertised (1914) by Montarioso Nursery.

AA. *Fls. yellow or red.*

B. *Infl. usually broader than long.*

flàvum, Roxbg. About 5 ft. tall: lvs. sessile, oblong, glabrous above, pale and hairy beneath: spike dense, the bracts broadly ovate or elliptic; fls. large, orange; corolla-tube cylindrical, 2½ in. long; segms. spreading, the outer ones linear and acute and an inch or so long, the lip very large and rounded, retuse; stamen not exserted. India. B.M. 3039 (and 2378?).

BB. *Infl. usually much longer than broad.*

Gardneriànum, Roscoe. Tall: lvs. sessile or the upper petioled: fls. light yellow, odd, short-stalked in the terminal spike, but the red filament long-projected beyond the segms.; lip oval and short, 3-toothed, the other segms. narrow: fr. red and showy. India. B.M. 6913. B.R. 774. J.H. III. 32:239 (in fruit). G.C. III. 11:176 (plate erroneously labeled *H. coronarium*); 46:126. G.W. 12, pp. 649, 650.—The best of the genus, and hardier than *H. coronarium.*

coccíneum, Buch.-Ham. St. about 6 ft. tall: lvs. all sessile, linear-lanceolate and sharp-pointed, glabrous above, glaucous beneath: fls. rather small, scarlet, the filament long-projected; lip nearly or quite entire; fl.-bracts conspicuous, acute or obtuse, triangular. India. L.B.C. 8:705.—A hybrid between this and *H. Gardnerianum* has been advertised as *H. Moòrei.*

H. Bousigonianum, Pierre. A species from Cochin-China with sts. about 3 ft., with small bright green lvs. and about 18–25 pale yellow fls. and red anthers has been recently intro. It is scarcely known outside England. R.H. 1906:400.—*H. cárneum,* Carey. Fls. flesh-colored, scentless: height 3–4 ft.: lvs. over 1 ft. long, acuminate. E. Indies. B.M. 2637. L.B.C. 7:693.

N. TAYLOR.†

HEDÝSARUM (Greek for *sweet smell*). *Leguminòsæ.* Perhaps a dozen North American herbs, and about sixty in the Old World, sometimes planted for ornament.

Perennial herbs or subshrubs, with odd pinnate lvs., and often showy racemes of red, purple or white, small pea-like fls.: calyx 5-cleft, the teeth nearly equal and pointed; standard obcordate or obovate; keel nearly straight and longer than the wings; stamens 9 and 1: fr. a flattened jointed pod.—Very closely allied to Desmodium, but the latter genus has 3-foliate lvs. Many of the hedysarums are attractive border plants. They

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are of easiest cult. in a light and open, well-drained soil. Give a sunny place; hardy. Prop. by division and seeds. For the sainfoin, sometimes known as *H. Onobrychis*, see *Onobrychis*.

A. *Fls. normally red (varying to white).*

coronàrium, Linn. FRENCH HONEYSUCKLE. Perennial or biennial, 2–4 ft. tall, branchy: an old garden plant with deep red, fragrant fls., crowded in axillary spikes or racemes: lvs. with 3–7 pairs of elliptic or roundish, somewhat pubescent lfts. Eu. Summer. Var. **álbum,** Hort., has white fls.—*H. hùmile,* Linn., is by some regarded as a form of this species, with rather more and narrower lfts., and wings only half as long as the keel.

AA. *Fls. normally purple (varying to white).*

multijùgum, Maxim. Hardy perennial of angular, straggling growth, 2–5 ft. high, very showy, and worthy of general cult.: fls. violet or purplish magenta, with yellow blotches, in racemes 8–18 in. long, all summer: lvs. 4–6 in. long, containing 6–12 pairs of grayish green oval, small lfts. Mongolia. Gn. 53:408. G.C. III. 18:8, 9. Excellent for rockwork. Var. **apiculàtum,** Sprague, has fewer lfts., which are apiculate, and glabrous above: perhaps the plant cult. as *H. multijugum.* B.M. 8091.

boreàle, Nutt. (*H. americànum,* Brit.). Erect or half-decumbent herb: sts. simple or nearly so, 1–3 ft.: lfts. 5–10 pairs, glabrous, oblong or oblanceolate: fls. violet-purple, varying to white, the calyx-teeth ovate-acute and shorter than the tube. Labrador and N. New England across the continent.

Mackénzii, Richards. Much like the last, but somewhat pubescent: fls. larger, violet-purple; calyx-teeth awl-like and acuminate, and longer than the tube, or at least equaling it: lfts. 5–9 pairs. Colo., north and west.

sibíricum, Poir. Height 3–4 ft.: lfts. ovate-lanceolate, glabrous, apiculate: fls. purple, drooping in long axillary racemes. Siberia. B.M. 2213 (as *H. alpinum*).

obscùrum, Linn. (*H. neglèctum,* Ledeb.). Small, usually about 6–12 in. high: lfts. 5–9 pairs, ovate, glabrous: fls. purple, pendulous in long spikes. Eu. B.M. 282.—It is said to vary to white. L. H. B.

HEDYSCÈPE (Greek, *sweet covering*). *Palmàceæ,* tribe *Arèceæ.* UMBRELLA PALM. A tall hothouse palm known to the trade as a Kentia, and resembling that genus in habit and foliage, but distinct in flower.

In Kentia the fls. are arranged in 4 ranks, and the ovule is fastened at the bottom of the cell, while in Hedyscepe (and its cult. allies, Kentiopsis, Veitchia, Nenga, Archontophœnix, Rhopalostylis and Dictyosperma) the fls. are spirally arranged in the branches of the spadix, and the ovule is fastened at the side. From the allies above mentioned Hedyscepe is distinguished by the following characters: staminate fls. with narrowly lanceolate sepals, 9–12 stamens, with long filaments; pistillate fls. with petals like the sepals and valvate at the apex. As a house plant, *H. Canterburyana* is dwarfer and more spreading than the two howeas, and has a lighter shade of green. G.C. II. 24:587.

H. Canterburyana, a very handsome palm, is the only species belonging to the genus, and, like the important howeas (or kentias of commercial horticulture), is known in a wild state only on Lord Howe's Island, where it is known as the "umbrella palm" from the recurving habit of its foliage. It grows at a greater altitude than the howeas, not appearing below the 900-feet level, and from this it may be inferred that a slightly lower temperature is more suitable for this palm; but in a general way the same conditions as those required by the so-called kentias will give good results with this subject, namely, a night temperature of 60° to 62° F., moderate shading throughout nearly the whole year, plenty of water, and a rich and rather heavy soil. These palms respond freely to generous treatment. As a commercial palm, *H. Canterburyana* is not very popular as yet, partly owing to the higher cost of seeds and the frequently low percentage of germination, and partly from the fact that in a young state this palm is by no means a rapid grower. In regard to hardiness of foliage,

1791. Hedyscepe Canterburyana.

it is fully equal to the kentias, and for gracefulness and symmetry of growth will compare favorably with any of the commercial species. In southern California it is cultivated outdoors. (W. H. Taplin.)

Canterburyàna, Wendl. & Drude (*Kéntia Canterburyàna,* F. Muell. *Veìtchia Canterburyàna,* Hort.) UMBRELLA PALM. Fig. 1791 (adapted from Martius). Tall, spineless palm, with a thick, stout caudex: lvs. terminal, dense, equally pinnatisect, the numerous segms. linear-lanceolate, acuminate, the lower nerves recurved at the base, rather remote from the margin; rachis arched, recurving: spadix with a short peduncle, and thickened, flexuose branches; areoles lax: fls. medium: fr. ovoid, large. R.H. 1873, p. 218. F.R. 1:85. G. 2:418; 5:592; 16:414. G.W. 12, p. 207 (the last four all as Kentia). N. TAYLOR.†

HERÈRIA: *Heterocentron.* **H. elegans:** *Schizocentron.*

HEÌMIA (Geheimerath. Dr. Heim, Berlin, died 1834). *Lythràceæ.* Two shrubs of the New World, differing from Decodon in the yellow mostly 6-merous trimorphous fls. borne in spikes: stamens 10–18. **H. salicifòlia,** Link (*Nesèa salicifòlia,* HBK.), native from Mex. to Buenos Ayres, is offered abroad: subshrub, about 5 ft.: lvs. opposite or in 3's, or the upper alternate, lanceolate and acute: fls. yellow, with obovate petals. This is said to be prized as an antisyphiiitic and for other purposes. L. H. B.

HELENIÓPSIS: *Heloniopsis.*

HELÈNIUM (possibly from Helenus, the son of Priam, but there is no clear record of the application of the name). *Compósitæ.* SNEEZE WEED. Hardy annual and perennial herbs, bearing yellow flowers from early summer to late autumn; only the perennials are in cultivation.

Stem erect, usually branching above: lvs. alternate, narrowly to broadly lanceolate, entire or toothed, glandular-dotted; the frequently decurrent petiole and st. sometimes winged: heads solitary or corymbose, yellow or brownish; disk-fls. perfect, fertile, their corollas 4–5-toothed; the ray-fls. pistillate or neutral, the rays wedge-shaped, 3–5-lobed.—About 30 species, N. Amer., Mex. Closely resembles Helianthus, but differs in having elongated, often top-shaped frs., which are never compressed and are usually silky villose; while

the frs. of Helianthus are generally more or less 4-sided and are smooth. In Helenium the receptacle is naked; in Helianthus it bears paleaceous bracts.

Heleniums thrive best in a rich, moist soil, with a sunny aspect, and are propagated by seeds, cuttings or division. All the species are very easily grown, the only serious difficulty being a white aphis which sometimes attacks the roots. If plants look unhealthy they should be lifted, washed with an insectiside and reset in a new place. The commonest species in cult. is *H. autumnale*, but perhaps the most valuable species for general planting is *H. Hoopesii*, which is one of our earliest blooming composites, and is also desirable for the border or for cut-flowers. *H. Hoopesii*, *H. Bolanderi* and *H. autumnale* will give bloom in succession from May to October. The first two are also attractive when grown in pots, but they do not flower from seed the first year, either in pots or in the open.

A. *Heads rayless.*

aromáticum, Bailey, n. comb. (*Graèmia aromática*, Hook. *Grahàmia aromática*, Spreng. *Cephalóphora aromática*, Schrad.). Erect, glaucous: st. herbaceous, much branched: lvs. alternate, linear-lanceolate, somewhat undulate and partially amplexicaul, the lower ones pinnatifid but the upper ones scarcely toothed: head discoid, terminating leafless branches; receptacle naked; florets yellow. Chile, in pastures and shrubby hills.—Offered abroad; fragrant. Listed in the trade as *Grahamia aromatica*, but all agree in referring Grahamia to Cephalophora; and Hoffmann now refers Cephalophora to Helenium. Whether the present species should really go under Helenium, is to be determined.

1792. Helenium autumnale. (×½)

AA. *Heads with rays.*

B. *St. and branches winged.*

C. *Disk yellow.*

autumnàle, Linn. (*H. grandiflòrum*, Nutt.). SNEEZEWEED. Fig. 1792. St. 2–6 ft. high, roughish, leafy: lvs. mostly toothed, smooth: heads 1–1½ in. across, numerous, borne at the end of short, very leafy stalks; rays drooping, 3-cleft, lemon-yellow to bright yellow; disk yellow. July–Oct. Moist places, Canada to Fla. and west to S. D., Kans. and Ala. B.M. 2994. Gn. 29:190; 55:218. A.G. 12:682. G.C. III. 10:433; III. 32:405.—Very showy. It has distinct merit for the back of borders, but is more appreciated in Eu. than in Amer. There are several garden forms: var. **pùmilum** is 1–2 ft. high, a very free bloomer, and is largely grown for cut-fls. in some places. J.H. III. 59:109. Var. **grandiflòrum** and var. **supérbum,** (*H. supérbum*, Hort.), are unusually vigorous and large-fld.; var. **striàtum,** has a maroon and gold disk, with yellow rays variously striped and splashed with rich crimson. J.H. III. 31:293. This should be distinguished from the striped forms of *H. nudiflorum*. Var. **grandicéphalum atropurpùreum** has almost entirely crimson fl.-heads. Var. **rùbrum** has deep red fls. A form known in the trade as *H. grandicephalum compactum bicolor* is also advertised. It seems to belong here.

CC. *Disk brown or purplish.*

D. *Lvs. all entire: heads solitary or few, long-stalked.*

Bigelovii, Gray. St. 2–3 ft. high, nearly smooth: upper lvs. narrow to oblong-lanceolate, lower spatulate: heads commonly 1½–2½ in. broad; rays ¾in. long; fl.-stalk slender. Aug. Wet ground, Calif. S.H. 1:373.

Bolánderi, Gray. St. 1–2 ft. high, stout, somewhat pubescent: lvs. oblong to ovate-lanceolate, the lower obovate: heads commonly 3 in. wide; rays often 1 in. long; fl.-stalks thick, hollow. June–Sept. Low ground, N. E. Calif. Gn. 24, p. 157; 29, p. 191. R.H. 1891, p. 377.—Sometimes grown as *H. grandiflorum*.

DD. *Lower lvs. toothed: heads numerous, corymbose, short-stalked.*

nudiflòrum, Nutt. St. 1–3 ft. high, roughish, leafy: lower lvs. spatulate, toothed: heads 1–1½ in. across; rays wedge-shaped, drooping, yellow, brown-purple or striped with both colors. July–Oct. Moist soils, N. C. to Fla., west to Ill. and Texas.—A garden form, var. **grandicéphalum striàtum,** has fls. over 2 in. across. This form is also sold under the trade name *H. cupreum*, a name of no botanical significance.

BB. *St. and branches not winged.*

Hoòpesii, Gray (*Dugáldia Hoòpesii*, Rydb.). St. 1–3 ft. high, stout, slightly tomentose when young, but soon smooth, branching above into an umbel of several to many fls.: lvs. thickish, entire: heads usually borne singly on long stalks, commonly 3 in. wide; rays but slightly drooping; disk yellow. May–Sept. Rocky Mts.—A very fine border plant, and especially valuable for cut-fls.

H. Doùglasii, Hort.=Monolopia major.—*H. tenuifòlium*, Nutt. Annual. A weed in the S. Atlantic and southwestern states. St. 8 in. to 2 ft. high, very leafy: lvs. thread-like, entire, sessile, often whorled. Va., Fla., west to Mo. and Texas. B.M. 7721.

S. W. FLETCHER.
N. TAYLOR.†

HELEÓCHARIS: *Eleocharis.*

HELIAMPHÒRA (Greek compound, meaning *sun pitcher*). *Sarraceniàceæ*. One of the three genera comprising this singular family, consisting of a single species from the upper lands of British Guiana, and rarely grown in choice glasshouse collections.

Heliamphòra nùtans, Benth., is a perennial, 1–2 ft. high: lvs. all radical and pitcher-form; pitcher tubular and enlarging above, with a flaring open erect oblique mouth and a very small rudimentary lid terminating the midrib, hairy inside and winged down the front, in its native habitat conspicuously veined with red: fls. several on a slender scape, nodding, white or pale rose, each pedicel subtended by a prominent bract; perianth in 4–6 parts which are ovate-pointed; style straight, scarcely enlarging at the stigma. B.M. 7093. G.C. III. 37:194.—This unusual plant was first discovered in 1839 by the brothers Schomburgk, and was rediscovered in 1881 by Burke, an English orchid-collector

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who brought plants to England. It is a rhizomatous plant, and is prop. by single crowns. The plant is described as growing well in small pots in a mixture of peat, sphagnum and sand, surfaced with sphagnum, the pot plunged to the rim in moss and kept under a bell-glass. It requires much moisture. L. H. B.

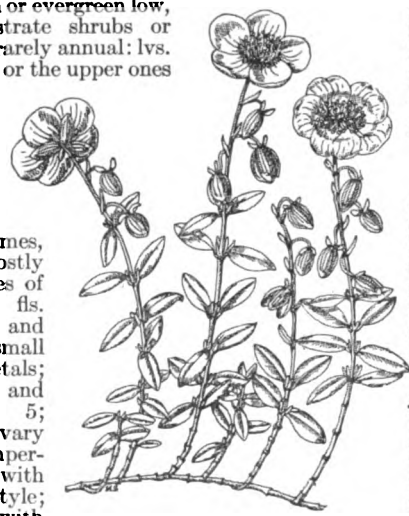
HELIANTHÉLLA (the plant resembles Helianthus). *Compósitæ.* Hardy perennial herbs from North America, with showy yellow heads borne in autumn.

Stem commonly unbranched: lvs. mostly scattered and sessile, linear or lanceolate, entire: heads solitary or few, with yellow infertile rays and a yellow or brownish disk.—Thirteen species. Helianthella belongs to a group of genera distinguished from Helianthus by having the frs. laterally compressed instead of thick and obtusely angled. Other cult. genera of this group are Actinomeris, Encelia and Verbesina, which are distinguished from one another by combinations of fr. and pappus characters.

The single species in cultivation is easily grown in a variety of soils, and is propagated by seeds or by dividing the rootstocks.

quinquenérvis, Gray. St. 2–4 ft. high, nearly smooth: lvs. mostly opposite, 4–9 in. long, the upper sessile: heads 3–5 in. broad, long-stalked, solitary or a few below in the axils of the lvs., with an involucre of large, leafy bracts; rays 15–20, pale yellow, 1½ in. long. June–Sept. Rocky Mts. S. W. FLETCHER.

HELIÁNTHEMUM (Greek for *sun flower*). Including *Halímium*, *Tuberària* and *Fumàna*. *Cistàceæ.* SUN ROSE. Ornamental woody or herbaceous plants grown chiefly for their showy flowers.



1793. Helianthemum Chamæcistus. (×⅓)

Half-evergreen or evergreen low, upright or prostrate shrubs or perennial herbs, rarely annual: lvs. usually opposite, or the upper ones alternate, rarely all alternate, small, entire, with or without stipules: fls. in terminal racemose, umbellate or subcapitate cymes, rarely solitary, mostly yellow, sometimes of 2 kinds, earlier fls. with large petals and later fls. with small or without petals; sepals 3, or 5 and unequal; petals 5; stamens many; ovary 1-celled or imperfectly 3-celled, with slender or short style; caps. 3-valved with many or several seeds; embryo curved like a ring or hook (subgen. Halimium), or straight or folded (Helianthemum proper).—About 110 species in N. Amer. (and 3 in. S. Amer.), Eu., N. Afr. and W. Asia. Monograph by Grosser in Engler, Das Pflanzenreich, hft. 14. Cistaceæ, pp. 33–131 (1903); another important work is Sweet's Cistineæ (1825–30) where many species are figured, quoted below as S. C.

The helianthemums are mostly suffruticose or shrubby, less often herbaceous plants, either upright and low, or cespitose or prostrate, with small and usually narrow, often grayish foliage and with yellow or white, less often pink or red, usually profusely produced flowers in terminal racemes or clusters, rarely solitary, appearing during the summer and followed by a capsular fruit inclosed or surrounded by the persistent sepals; the flowers open only in the sun and the delicate petals soon drop. Most of the species are not hardy North without protection and are particularly suited to warmer and drier climates, but *H. Chamæcistus* is fairly hardy North, though in exposed situations it also profits by a protection of mulch: the hardiest of the species mentioned below is *H. canadense*, but it is at the same time the least attractive. They all thrive well in poor sandy or rocky soil, most of them being partial to limestone soil, and demand a sunny position to bloom profusely. They are especially adapted for rockeries and borders particularly the numerous forms of *H. Chamæcistus* which form dense mats; most of the other species are of low twiggy habit. Propagation is mostly by division, also by greenwood cuttings and by seeds which germinate readily, but if several species are grown together the seeds are liable to produce hybrids.

INDEX.

algarvense, 2.
angustifolium, 7.
appeninum, 6.
canadense, 1.
Chamæcistus, 7.
cupreum, 7, 8.
diversifolium, 7.
formosum, 3.
grandiflorum, 7.
hyssopifolium, 7.
lasianthum, 3.
macranthum, 7.
multiplex, 7.
mutabile, 7.
ocymoides, 2.
pilosum, 5.
polifolium, 6, 7.
pulverulentum, 6.
rhodanthum, 6.
roseum, 6, 7, 8.
stramineum, 7.
sulphureum, 8.
tomentosum, 7.
umbellatum, 4.
variabile, 7.
venustum, 7.
vulgare, 7.

A. *Style short and straight, or almost wanting: lvs. without stipules.* (*Halimium.*)

B. *Fls. of 2 kinds, the larger solitary or rarely in 2's, the smaller apetalous ones clustered on lateral branchlets; sepals 5.*

1. **canadénse,** Michx. (*Halímium canadénse*, Grosser). FROSTWEED. Upright, 1–2 ft., hoary pubescent: lvs. nearly sessile, oblong to linear-lanceolate, acutish, pale beneath, ½–1⅓ in. long: the larger fls. 1 in. across, yellow; sepals 5, the outer linear, the inner ovate, tomentulose. June–Aug. Maine to Mich., south to N. C. and Miss.—Occasionally offered by dealers in native plants.

BB. *Fls. all large and showy, 1½–2 in. across; sepals 3.*

C. *Color of fls. yellow.*

2. **ocymoìdes,** Pers. (*H. algarvénse*, Dun. *Cistus algarvénsis*, Sims). Nearly erect, twiggy shrub, 2–3 ft., hoary-pubescent: lvs. short-petioled, oblong-lanceolate to oblong-spatulate, recurved at the apex, grayish, those of the flowering branchlets sessile, green, ¼–½, rarely to 1½ in. long: fls. yellow with purple eye, 1½ in. across, in loose, long-stalked corymbose clusters; sepals ovate-lanceolate. Spain and Portugal. B.M. 627, 5621. S.C. 40, and vars. 26, 65, 96.

3. **lasiánthum,** Pers. (*H. formòsum*, Dun. *Cistus formòsus*, Curtis). Spreading upright shrub, tomentose: lvs. short-stalked, oval to ovate-oblong or lanceolate, obtuse or acutish, often revolute on the margin, white-tomentose while young, ½–1 in. long: fls. yellow, the petals often spotted purple at the base, 2 in. across, in 1–5-fld. cymes; sepals ovate. Spain and Portugal. B.M. 264. S.C. 50. Gn. 26:420; 53, p. 131. G.M. 34:246. F.S.R. 2, p. 45. G. 16:382.—The most showy species of the genus.

CC. *Color of fls. white.*

4. **umbellàtum,** Mill. (*Cistus umbellàtus*, Linn.). Low shrub, upright or procumbent, 1–2 ft.: lvs. sessile, linear or linear-lanceolate, grayish tomentose beneath, pubescent above, later glabrescent, more or less viscid, ¾–1¼ in. long: fls. about 1 in. across, in whorls or racemose whorls; sepals ovate. Cent. S. Eu. N. Afr. S.C. 5.

AA. *Styles slender, often curved; sepals 5, the 2 outer ones smaller.* (*Helianthemum proper.*)

B. *Stipules subulate, the lower and middle ones about as long as petioles: fls. white or pink.*

5. **pilòsum,** Pers. Low nearly upright or ascending subshrub: lvs. short-petioled, linear or oblong, revolute,

grayish tomentose on both sides or green above, ⅛–¾in. long: fls. white, the petals with yellow blotch at the base, about 1 in. across, in 4–8-fld. cymes; outer sepals oblong or linear, inner ones broadly oval, ⅛–⅓in. long. S. W. Eu., N. Afr. S.C. 49.

6. **apenninum,** Lam. (*H. polifòlium*, Pers.). Upright or procumbent subshrub, hoary-pubescent: lvs. petioled, elliptic to linear-oblong, grayish tomentose on both sides or green above, ⅓–¾, rarely to 1½ in. long: fls. white, the petals with yellow blotch at the base, 1 in. across in 3–10-fld. cymes; outer sepals linear-oblong, inner ones broadly oval, about ⅓in. long. W. and S. Eu., W. Asia. S.E.B. 2:159. S.C. 62. R. F. G. 3:33 (4554). Var. **rôseum,** Grosser (*H. rhodánthum*, Dun. *H. pulveruléntum* var. *ròseum*, Willk.). Lvs. lanceolate, acutish, ¾–1½ in. long: fls. over 1 in. across, pink to crimson. S.C. 7.

BB. *Stipules lanceolate or subulate, all longer than the petioles: fls. normally yellow, also white or pink.*

7. **Chamæcístus,** Mill. (*H. vulgàre*, Gärtn. *H. variábile*, Spach). Fig. 1793. Low procumbent subshrub, rarely upright: lvs. petioled, usually flat, ovate to linear-lanceolate, green on both sides, hairy or nearly glabrous, ½–1½ in. long: stipules lanceolate: fls. normally yellow, about 1 in. across, in many-fld loose racemes; outer sepals much shorter than the inner broadly oval ones. Eu., W. Asia., N. Afr. L.B.C. 3:202. R.F.G. 3:30 (4547, as var. *concolor*). G.W.H. 111.—This is an exceedingly variable species and numerous forms are cult. in European gardens; the following are perhaps the most noteworthy: Var. **grandiflòrum,** Fiek (*H. grandiflòrum*, Lam.). Lvs. ovate to oblong, green on both sides: fls. yellow, 1¼ in. long. Var. **cùpreum,** Grosser (*H. hyssopifòlium* var. *cùpreum*, Sweet). Lvs. oval to lanceolate, green on both sides: fls. copper-colored, darker toward the base, 1¼–1⅓ in. across. S.C. 58. Var. **tomentòsum,** Grosser (*H. tomentòsum*, Dun. *H. angustifòlium*, Pers. *H. polifòlium*, Hort.). Lvs. oblong to oblong-lanceolate, flat or revolute at the margin, white-tomentose beneath, ¼–¾in. long: fls. yellow. S.E.B. 2:158 and S. C. 34 (as *H. vulgare*). R.F.G. 3:30 (4547, as var. *discolor*). There is a double-fld. form, var. *tomentòsum múltiplex*, Grosser. S.C. 64. Var. **rôseum,** Grosser (*H. ròseum*, Sweet). Lvs. lanceolate, white-tomentose beneath: fls. pink, 1¼ in. across. A form with semi-double fls. is var. *ròseum múltiplex*. S.C. 86. Var. **venústum,** Grosser. Lvs. lanceolate, revolute, white-tomentose beneath: fls. crimson with yellow eye, over 1 in. across. S.C. 10. Var. **mutábile,** Grosser. Lvs. ovate-oblong, flat, grayish tomentose beneath: fls. at first light rose, changing to lilac, finally nearly white. S.C. 106. R.F.G. 3:35 (4556). Var. **stramíneum,** Grosser. Lvs. oval to oblong-lanceolate, flat, white-tomentose below: fls. bright straw-yellow, over 1 in. across. S.C. 93. There is a double-fld. form, var. *stramíneum múltiplex*. S.C. 94. Var. **diversifòlium,** Grosser. Lvs. oval to oblong- or linear-lanceolate, white-tomentose beneath: fls. purplish pink, the petals with a darker copper-colored blotch at the base. S.C. 95. A double-fld. form with purplish red fls. is var. *diversifòlium múltiplex*. S. C. 98. Var. **macránthum,** Grosser. Lvs. ovate-oblong, rather large, thinly grayish tomentose beneath: fls. white, nearly 1¾ in. across, the petals blotched yellow at the base. S.C. 103. There is a form with very double fls., var. *macránthum múltiplex*. S.C. 104.

8. **sulphûreum,** Willd. (*H. apenninum* × *H. Chamæcistus*). Procumbent sub-shrub: lvs. petioled, lanceolate, hairy on both sides, dark green above, grayish beneath, ½–¾in. long; stipules subulate: fls. sulfur-yellow, darker toward the base, about 1 in. across; the 2 outer sepals very small, narrow-lanceolate, the inner ovate. S.C. 37. There is a form with pink fls., var. **rôseum** (S.C. 51 as *H. canescens*), and one with copper-colored fls., var. **cûpreum** (S.C. 66).

H. alpéstre, Dun. (H. oelandicum var. alpestre, Benth.). Cespitose subshrub: lvs. ovate-lanceolate to lanceolate, hairy or glabrescent, ½–¾in. long: fl. yellow, ½in. across. Mountains of S. Eu. S.C. 2.—*H. globulariæfòlium*, Pers. (Tuberaria globulariifolia, Willk.). Perennial; lvs. mostly radical, long-stalked, ovate, hairy, 1–2 in. long: fls. in simple or branched racemes, yellow with purple eye, 1¾ in. across. S. Eu., N. Afr. B.M. 4873 (as H. Tuberaria).—*H. lunulàtum*, Lam. Cespitose subshrub: lvs. elliptic-oblong, green on both sides, glabrescent or sparingly hairy, ⅛–⅓in. long: fls. solitary, yellow, ½in. across; petals with crescent-shaped spot at the base. Italy. R.F.G. 3:26 (4529).—*H. Tuberària*, Mill. (Tuberaria vulgaris, Willk.). Perennial: lvs. mostly radical, oval-lanceolate to obovate, grayish tomentose beneath, 1–3 in. long: fls. in simple or branched racemes, yellow, 1½ in. across. S. Eu., Afr. S.C. 18.—*H. Tuberària*, Hook. f.=H. globulariæfolium.

ALFRED REHDER.

HELIÁNTHUS (Greek, *helios*, the sun, and *anthos*, a flower). *Compósitæ*. Including *Harpálium*. SUNFLOWER. Hardy herbaceous perennial and annual plants, rather coarse in habit, with yellow flowers which are mostly large, numerous and borne in autumn.

Leaves generally opposite below and alternate above, but this is not a constant character: heads pedunculate, solitary or corymbose, terminating the st. or branches; disk-fls. perfect, yellow, brown or purplish, with a tubular 5-limbed corolla; rays neutral, yellow.—Altogether there are about 60 species, mostly N. American, and many of the plants grown for sunflowers are now considered as belonging to other genera. The genus is very variable, and there are also many natural hybrids; hence the species are difficult to delimit. The old notion that the flower-heads follow the sun from east to west has been substantiated for *H. annuus*. (See Botanical Gazette, vol. 29:197.) Garden monographs are found in Gn. 27, p. 66; 45, p. 372; 49, p. 326 and 55, p. 146.

Sunflowers are of the easiest culture, and are adapted to a variety of soils. They are seen to best advantage when planted in masses, rather than as solitary specimens, and should be given plenty of room, being gross feeders. Most sunflowers, especially *H. annuus*, are too coarse to be harmonious near the house, but find an effective setting in the background, against the shrubbery border. A few species, however, especially *H. orgyalis* and *H. debilis*, are worth growing for their foliage alone. The annual species are propagated by seeds or cuttings; the perennial chiefly by division. All varieties of *H. multiflorus* root readily from both soft and hardwood cuttings. The double forms rarely produce fertile seeds and must be propagated by division. The seeds of annuals may be planted directly in the border, but it is best to start them indoors in March. Perennial kinds, particularly forms of *H. multiflorus*, should be taken up in late fall or early spring, every two years, and the rootstocks divided and replanted; otherwise the roots will ramble away, and the flowers will deteriorate. All thrive in a light, dry soil; but *H. annuus* and *H. giganteus* may be used to advantage for drying malarial spots. Sunflowers do not thrive in very shady places.

Commercial uses and cultivation of the common sunflower. (M. G. Kains).

Sunflowers (*H. annuus*) are cultivated extensively in Russia, India and Egypt; less widely in Turkey, Germany, Italy and France. The seeds from the large-seeded variety are sold upon the streets in Russia as we do peanuts, except that they are eaten raw. The small-seeded variety is preferred for the manufacture of oil. When cold-pressed, a citron-yellow sweet-tasting oil, considered equal to olive or almond oil for table use, is produced. The resulting oil-cake, when warm-pressed, yields a less edible fluid, which is used for lighting, and in such arts as woollen dressing, candle- and soap-making. The oils dry slowly, become turbid at ordinary temperatures and solid at 4° F. For stock and poultry feeding, and for other purposes, sunflower oil-cake is about equal in value to that of flax- and cotton-seed. The cake is largely exported by Russia to Denmark and

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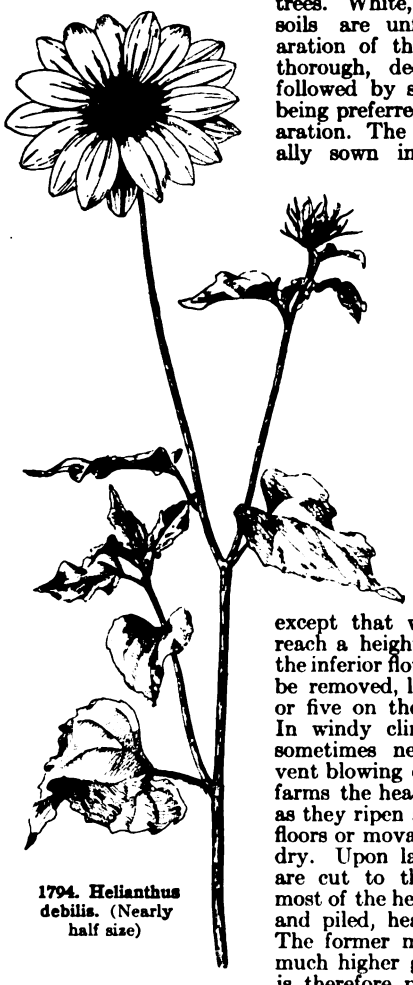
Sweden, and to some extent to other European markets. Sunflower stems and heads make an excellent paper, and the stems furnish a fine fiber that compares favorably with silk. They are, however, generally used for fuel, since the above industries have not been developed. —Sunflowers grow readily in many soils, but best results are secured upon light, rich, calcareous or alluvial land, well supplied with moisture and unshaded by trees. White, clayey and poor soils are unfavorable. Preparation of the soil should be thorough, deep fall plowing followed by spring harrowing being preferred to spring preparation. The seeds are generally sown in drills running north and south, 30 inches apart, 9 inches asunder in the drill, and 1 inch deep. Sometimes they are transplanted from nursery beds when 4 to 6 inches tall. About a week after the plants appear they are thinned to 18 inches apart. From four to six pounds of the seed will sow an acre. Cultivation is the same as for corn, except that when the plants reach a height of 3 to 4 feet, the inferior flower-heads should be removed, leaving only four or five on the principal stem. In windy climates hilling is sometimes necessary to prevent blowing down.—On some farms the heads are harvested as they ripen and placed upon floors or movable pole-racks to dry. Upon larger areas they are cut to the ground when most of the heads have ripened and piled, heads up, to cure. The former method insures a much higher grade of oil, and is therefore preferred. Every effort is made to prevent fermentation, either in the heads or in the pile of seeds, since this injures the quality of the oil. When thoroughly dry the heads are either placed on racks or piled, face downward, on a floor and beaten with flails. The seeds are then spread thinly, shoveled over occasionally, and allowed to become perfectly dry before being sent to the mill. The average yield is about fifty bushels to the acre. The percentage of husks ranges from 40 to 60; and the oil from 15 to 28. As a general rule, 100 bushels of seed will yield 33 bushels of kernels, 100 bushels of kernels from 280 to 320 gallons of oil of both qualities. Russian sunflower, a large-seeded variety, producing a single head, grows 8 feet tall, but is less esteemed for oil-production than the small-seeded varieties. In America the sunflower industry is small.



1794. Helianthus debilis. (Nearly half size)

The red sunflower. (T. D. A. Cockerell.)

In the summer of 1910 Mrs. Cockerell found a red sunflower growing by the roadside close to her home at Boulder, Colorado. It was a variation of the native sunflower of the plains (*Helianthus annuus* var. *lenticularis*, or *H. lenticularis*), having the rays suffused with chestnut-red. It was named var. *coronatus*, the arrangement of the red, with the black disk, suggesting the sun in eclipse, with its corona. Since the sunflower is sterile with its own pollen, it was necessary to cross the red one with yellow-rayed kinds, such as the garden *H. annuus*, and the yellow-rayed wild plant. The next summer, it was found that about half the progeny had red rays: it was determined that red was dominant, and assumed that the plant originally found was heterozygous for red, through variation occurring in a germ-cell. Crossing red with red, homozygous or pure-bred reds were obtained, with very rich colors. Most sunflowers carry a factor for marking, which affects the distribution of red, so that many of the flowers were bicolored with the ends of the rays yellow (var. *bicolor*) while others had a ring of red (var. *zonatus*). Some had the rays entirely chestnut-red (var. *ruberrimus*). A variety obtained in 1914 had the rays practically black. So far, the red of the red sunflowers was a chestnut, or brown-red. The pigment, however, belongs to the anthocyan group, and is chestnut only because seen on a background of orange. In order to obtain a new color, the homozygous red was crossed with Sutton's primrose variety (var. *primulinus*, Ckll., "Science," August 29, 1913, page 312). In the first generation (raised in the greenhouse during the winter) the flowers were all red on orange, or chestnut-red. These crossed together gave seventy-one chestnut-red, nineteen yellow, twenty-five wine-red and eight primrose; theoretical expectation, according to Mendel's law, being sixty-nine, twenty-three, twenty-three, and eight. The wine-red is due to the same anthocyan pigment, but on a primrose-yellow (pale yellow) background. In good examples, the color is nearly that known as "old rose." The various patterns are as in the chestnut-red forms. The wine-red sunflower was named var. *vinosus*. In addition to the above, various other varieties have been developed, including red and wine-red semi-doubles and doubles. There are also hybrids with *Helianthus cucumerifolius*, of relatively small stature and with shiny foliage. One of these hybrids, represented in the 1914 cultures by a number of plants, may be described as follows: About 4 feet high, spreading, much branched: stems speckled with purple: leaves dark green, very shiny; blades broad and short, strongly dentate: involucral bracts with long tapering ends (but not so long as in true *H. cucumerifolius*); disk small (about 1 inch diameter); rays ample, broad, numerous, with basal half rich chestnut, apical half bright lemon; disk very dark. This is a plant of the second generation from the original cross. For further details see "Popular Science Monthly," April 1912; "Science," August 29, 1913, pages 312, 313; August 21, 1914, pages 283–285, November 13, 1914, pages 708, 709 and January 1, 1915, pages 33, 34. "Garden Magazine," July, 1914. The red sunflower is now offered by the trade in America, England, Germany and Italy. It has also been grown successfully in Australia and New Zealand.

INDEX.

æstivalis, 6.
angustifolius, 5.
annuus, 1.
argophyllus, 2.
atrorubens, 7.
bicolor, 1.
californicus, 1, 19.
citrinus, 1,
cordatus, 17.
cucumerifolius, 3.
debilis, 3.
decapetalus, 11.
divaricatus, 12.
doronicoides, 16.
duplex, 11.
flore-pleno, 11.
giganteus, 13.
globosus, 1.
grandiflorus, 6, 11.
grosse-serratus, 9.
hirsutus, 21.
lætiflorus, 20.
lævigatus, 8.
lenticularis, 1.
macrophyllus, 10.
major, 11.
Maximilianii, 14.
maximus, 11.
missourienesis, 6.
mollis, 17.
multiflorus, 11.
nanus, 1.
niger, 1.
orgyalis, 4.
plumosus, 3.
primulinus, 1.
pumilus, 18.
purpureus, 3.
rigidus, 6.
ruberrimus, 1.
scaberrimus, 6.
sparsifolius, 7.
semi-plenus, 6, 20.
simplex, 11.
strumosus, 10.
subtuberosus, 13.
texana, 2.
trachelifolius, 22.
tuberosus, 15.
variegatus, 1.
vinosissimus, 1.
vinosus, 1.
zonatus, 1.

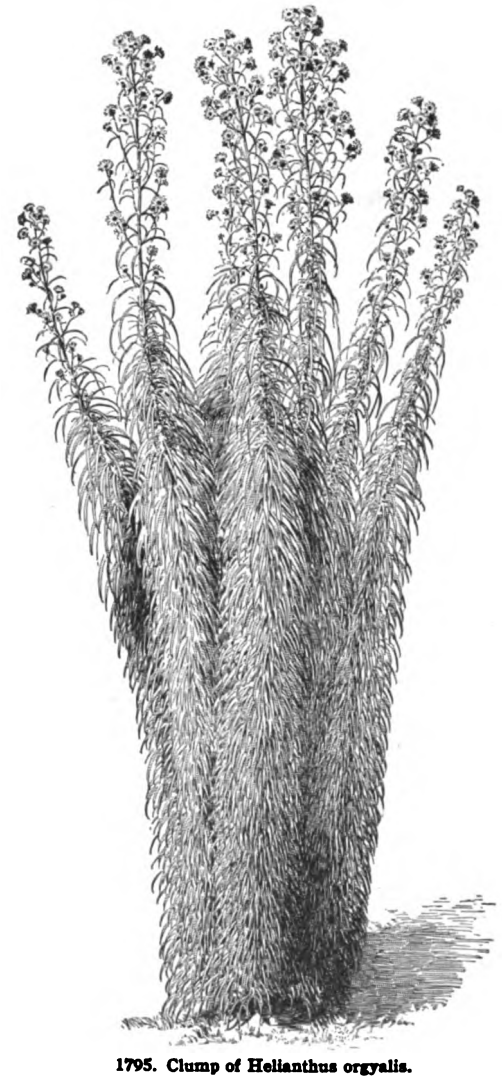
KEY TO THE SPECIES.

A. *Plants annual: lvs. long-petioled: disk brown or purplish.*
B. *St. erect, stout, simple or branching above.*
C. *Pubescence rough* ..... 1. **annuus**
CC. *Pubescence usually silky* ..... 2. **argophyllus**
BB. *St. diffuse, slender, branching freely from the base* ..... 3. **debilis**
AA. *Plants perennial by creeping rootstocks: lvs. sessile or short-petioled.*
B. *Disk brown or purplish.*
C. *Lvs. linear, entire (except the lower), sessile.*
D. *St. rough* ..... 4. **orgyalis**
DD. *St. usually smooth* ..... 5. **angustifolius**
CC. *Lvs. ovate to broad-lanceolate, mostly toothed, narrowed at the base into a winged petiole.*
D. *Rays numerous, the fls. 2½–4 in. broad* ..... 6. **scaberrimus**
DD. *Rays 10–16, about 1 in. long* .. 7. **atrorubens**
BB. *Disk yellowish.*
C. *St. smooth below, the branches often slightly rough or pubescent.*
D. *Foliage pale beneath.*
E. *Lvs. prevailingly lanceolate.*
F. *The lvs. glabrous on both sides* ..... 8. **lævigatus**
FF. *The lvs. roughened beneath* ..... 9. **grosse-serratus**
EE. *Lvs. prevailingly ovate* ..... 10. **strumosus**
DD. *Foliage green on both sides.*
E. *Lvs. stalked* ..... 11. **decapetalus**
EE. *Lvs. sessile or nearly so* .... 12. **divaricatus**
CC. *St. rough or hairy below.*
D. *Rootstocks thickened into one or more fleshy tubers.*
E. *Lvs. prevailingly lanceolate.*
F. *The lvs. rough only above.* 13. **giganteus**
FF. *The lvs. rough both sides* .. 14. **Maximilianii**
EE. *Lvs. prevailingly ovate* ..... 15. **tuberosus**
DD. *Rootstocks all slender.*
E. *Lower lvs. sessile or with a clasping base.*
F. *Lvs. sessile* ..... 16. **doronicoides**
FF. *Lvs. cordate, clasping* .... 17. **mollis**
EE. *Lower lvs. short-petioled.*
F. *St. 1–2 ft., not branching* .. 18. **pumilus**
FF. *St. usually over 3 ft., branching.*
G. *The st. smooth and glabrous* ..... 19. **californicus**
GG. *The st. usually rough and hispid.*
H. *Foliage equally rough on both sides* ..... 20. **lactiflorus**
HH. *Foliage rougher above than beneath.*
I. *The lvs. short-petioled* ..... 21. **hirsutus**
II. *The upper lvs. narrowed at the base.* 22. **tracheliifolius**

1. **ánnuus,** Linn. COMMON SUNFLOWER. St. 3–12 ft., rough-hairy, often mottled: lvs. 4–12 in. long, broadly ovate, acute, the lower cordate, coarsely serrate, rough on both sides, 3-nerved: fls. 3–6 in. wide in wild specimens, often 14 in cult. July–Sept. Minn. to Texas, west to Wash. and Calif. Gn. 27, p. 68. Gt. 43, p. 95 and B.R. 1265 (as *H. lenticularis*).—A valuable economic and ornamental plant. The lvs. are used for fodder, the fls. yield a yellow dye, the seeds furnish an oil and are used for food. It is grown for food chiefly in Russia. *H. annuus* has long been in cult. as an ornamental, and has varied into many distinct forms. Common varieties are: Var. **californicus,** Hort., very large and double; var. **citrinus,** Hort., with primrose-colored rays (Gn. 49, p. 327); var. **globòsus fistulòsus,** Hort., enormous globular heads (Gn. 27, p. 68); var. **nànus fl. pl.,** Hort., (Globe of Gold), dwarf and double, valuable for borders; **Russian Giant,** 10–12 ft. high, single, grown mostly for seed; var. **variegàtus,** Hort., with variegated lvs.

The *H. lenticulàris,* Douglas, is commonly referred to *H. annuus.* Cockerell supposes, however, that *H. lenticularis* is the wild species from which the cultivated forms of *H. annuus* are derived. Even so, *H. annuus,* being a Linnæan name, must stand. The many interesting mutations and hybrids observed and produced by Cockerell are based on the wild *H. annuus* (or *H. lenticularis*). Placing his variants under *H. lenticularis,* he names them as follows: Var. *bicolor,* Ckll., rays red, tipped yellow; var. *zonàtus,* Ckll., rays red-banded; var. *rubérrimus,* Ckll., rays chestnut-red throughout; var. *primúlinus,* Ckll., primrose-yellow; var. *vinòsus,* Ckll., rays wine-red; var. *vinossissimus,* Ckll., rays entirely dark wine-red; var. *niger,* Ckll., rays practically black above and slightly red at tip. This group of variants comprises the red sunflowers, now in cult. (See account also by Cockerell, page 1446.)

2. **argophýllus,** Torr. & Gray. SILVERY-LEAVED SUNFLOWER. St. usually solitary, 4–5 ft. high, soft gray, with a dense, silky pubescence, especially the upper branches. Otherwise like *H. annuus,* into which it seems to vary under cult. if the seedlings are not constantly selected for their silky character. Texas. The



1795. Clump of Helianthus orgyalis.

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var. **texàna,** Hort., which does not differ botanically from the type, is an attractive form of this species. R.H. 1857, p. 431. Gn. 12, p. 280; 27, p. 67; 55, p. 147.

3. **débilis,** Nutt. (*H. cucumerifòlius,* Torr. & Gray). CUCUMBER-LEAVED SUNFLOWER. Fig. 1794. St. 1–4 ft. high, usually several together, hairy throughout:

1796. Helianthus decapetalus var. multiflorus.
(See species No. 11)

branches often mottled with purple or white, each one bearing a fl.: lvs. 1–4 in. long, ovate to triangular, generally with a cordate base, thin, glossy, irregularly toothed or entire: fls. 2–3 in. wide, on slender peduncles. July–Sept. Fla. to Texas and westward. G.C. III. 17: 167. Gt. 44, p. 571. B.M. 7432. Gn. 49:326.—This is one of the best for cut-fls. It needs a sandy soil. Var. **plumòsus,** Hort. Disk-florets ligulate, from pale to deep yellow. Var. **purpûreus,** Hort. Ray-florets varying in color from light pink to deep purple.

4. **orgyàlis,** DC. Fig. 1795. St. 8–10 ft. high, strict, smooth, very leafy to the top: lvs. 8–16 in. long, acuminate, slightly rough, drooping: fls. numerous, lemon-yellow. Sept., Oct. Dry plains, Neb. to Texas and westward. Gn. 27, p. 67; 55, p. 147. F.R. 2:146.—This species has distinct and attractive foliage, which is not at all coarse. A well-grown plant will produce spikes of fls. nearly 4 ft. long.

5. **angustifòlius,** Linn. SWAMP SUNFLOWER. St. 2–6 ft. high, simple or branching above, slightly rough: lvs. 2–7 in. long, somewhat tufted, drooping, in dried-up specimens with rolled edges, smooth or slightly rough: fls. 2–3 in. wide, few or solitary. Aug.–Oct. Wet land, N. Y. to Fla., west to Ky. and Texas. B.M. 2051.

6. **scabérrimus,** Ell. (*H. rigidus,* Desf. *H. missouriénsis,* Schwein.). St. 1–3 ft. high (rarely 5–8 ft.), strict, sparingly branched, rough or hairy: lvs. 6–12 in. long, oblong to ovate-lanceolate, firm, thick, rough-hairy, entire or slightly toothed: fls. 2½–4 in. wide, showy, long-stalked; rays numerous, about 1½ in. long; disk sometimes yellow at first, turning brown. Aug.–Oct. Minn. to Ill., Ga., and Texas prairies. B.R. 508 (as *H. atrorubens*). B.M. 2020 (as *H. diffusus*); 2668 (as *H. atrorubens*). Gn. 27, p. 68. G. 3:391; 17: 544 (both as *Harpalium rigidum*).—After *H. decapetalus* this species is one of the best perennial sunflowers. It varies under cult. chiefly in the direction of doubling and in lengthening the blooming period. Some of the best garden varieties are **æstivàlis, grandiflòrus, semiplènus** and **Miss Mellish.**

7. **atrórubens,** Linn. (*H. sparsifòlius,* Hort.). PURPLE-DISK SUNFLOWER. St. 2–5 ft. high: lvs. usually thin, sometimes hoary beneath: fls. about 2 in. across; rays few (10–16), rarely over 1 in. long; disk dark red. Otherwise like *H. rigidus,* to which it is inferior. Va. to Fla., west to Ohio and La. G.M. 52:827 (as *H. sparsifolius*).—Suitable for dry shady places.

8. **lævigàtus,** Torr. & Gray. St. 2–5 ft., simple or branched above: lvs. 3–6 in. long, lanceolate, smooth, entire or slightly toothed: fls. 1–1½ in. broad, few or solitary; rays 6–10, usually less than 1 in. long. Aug.–Oct. Va. to N. C.

9. **gròsse-serràtus,** Mart. St. 6–10 ft. high, very smooth, glaucous, the smaller branches strigose: lvs. long-lanceolate, slender-petioled, rough above, densely hairy or canescent beneath: fls. many, cymose, 1–3 in. broad; rays 10–20, deep yellow. Aug.–Oct. N. Y. and Pa. to Mo., south to Texas.—Passes into *H. giganteus.*

10. **strumòsus,** Linn. St. 3–7 ft. high, usually branching, often glaucous: lvs. 3–8 in. long, ovate-lanceolate, rough above, entire or toothed: fls. 2½–4 in. across; rays 8–15, 1–1½ in. long. July–Sept. Open woods, Canada to Ga. and west to Wis. and Ark. Var. **macrophýllus,** Britt. Lvs. downy beneath. B.M. 3689 (as *H. mollis.*).

11. **decapétalus,** Linn. WILD SUNFLOWER. St. 2–5 ft. high, branched above: lvs. 3–8 in. long, ovate-lanceolate, sharply serrate, thin, rough above, finely pubescent beneath: fls. 2–3 in. across, numerous; rays light yellow, generally more than 10, in spite of the specific name. July–Sept. Moist soils, Que. to Ga., west to Mich. and Ky. G.C. II. 16:601.—Under cult. it has given rise to the horticultural var. **multiflòrus,** (*H. multiflòrus,* Hort.). Fig. 1796. B.M. 227. G.C. III. 10:421. Gn. 27:66, pp. 71, 74; 45, p. 373. Gt. 43, p. 554. Gng. 3:83. F.R. 2:413. G. 21:592. G.W. 47:627.—The many garden forms of var. *multiflorus* differ mainly in the extent of doubling, season of blooming, habit of plant and size of fl. Among the best are: Var. **flòre-plèno** (sometimes advertised as var. **dûplex**) and var. **grandiflòrus,** almost completely double (G. 4:427; 11:231); var. **màjor,** fls. larger than common (G. 4:163); var. **máximus,** very large, single fls. with pointed rays; var. **símplex,** an alleged single form; **Soliel d'Or,** with quilled florets, like a cactus dahlia. Multiflorus varieties are the most popular of perennial sunflowers, and deservedly so. If the double forms are grown on poor soil, or are allowed to remain for several years without being divided, they become single.

12. **divaricàtus,** Linn. Fig. 1797. St. 1–6 ft. high, glabrous or slightly rough at the summit: lvs. sessile, rough above, pubescent beneath, 3-nerved, standing out nearly at right angles to the st.: fls. few or solitary, 2 in. across; rays 8–15. July–Sept. Dry woodlands, Canada to Fla., west to Neb. and La.

13. **gigantèus,** Linn. INDIAN POTATO. St. 3–12 ft. high, stout: lvs. 3–7 in. long, lanceolate, very rough, serrate or nearly entire: fls. usually several, 1½–3 in.

1797. Helianthus divaricatus.

broad, mostly long-stalked; rays 10–20, barely 1 in. long, cupped, pale yellow: seeds smooth. Aug.–Oct. Wet ground, Canada to Fla., west to Neb. B.M. 7555. G.W. 2, p. 44; 7, p. 451; 8, p. 469. Var. **subtuberòsus,** Brit. A northern form with unusually fleshy roots,

1798. Helianthus mollis var. cordatus.

which were formerly collected by Indians for food; hence "Indian potato."

14. **Maximílianii,** Schrad. St. generally 2–4 ft. high, sometimes 8–10: lvs. inclined to be trough-shaped: fls. on short, densely pubescent peduncles; rays 15–30, generally 1½ in. long, deep yellow. Otherwise like *H. giganteus,* of which it is probably the western form. Aug.–Oct. Dry plains, west of Mississippi River. V. 20:169.

15. **tuberòsus,** Linn. JERUSALEM ARTICHOKE. St. 5–12 ft., branched above: lvs. 4–8 in., usually ovate, acuminate, serrate, rough above, finely pubescent beneath: fls. several or numerous, 2–3 in. across; rays 12–20: seeds pubescent. Gn. 27, p. 68. B.M. 7545.—Frequently cult. for its edible tubers. See *Artichoke, Jerusalem.*

16. **doronicoìdes,** Lam. St. 3–7 ft. high: lvs. 4–8 in. long, ovate-oblong, narrowed toward both ends, rough on both sides, finely toothed: fls. numerous, in loose panicles; rays 12–20, broad. Otherwise as *H. lætifolius.* Aug., Sept. Dry soils, Ohio to Mich., Mo., and Ark. B.M. 2778 (as *H. pubescens*).

17. **mòllis,** Lam. St. 2–5 ft. high, stout, very leafy, hoary villose, at least when young: lvs. 3–5 in. long, ovate-lanceolate, white-pubescent or rough on upper side: fls. solitary or few, 2–3 in. broad; rays 15–25. July–Sept. Barren soils, Ohio to Ga., west to Iowa and Texas; also on L. I. Gn. 55:146. Var. **cordàtus,** Fig. 1798, has recently been discovered. It has broader, thicker and cordate lvs. G.F. 2:137 (adapted in Fig. 1798).

18. **pùmilus,** Nutt. St. rough and hairy throughout: lvs. only 5–7 pairs, 1–4 in. long, ovate-lanceolate: heads few, short-peduncled; disk yellow. E. Rocky Mts. and adjacent plains.

19. **californìcus,** DC. St. 3–8 ft. high: lvs. lanceolate, serrate, rough on both sides: fls. loosely paniculate, about 2½ in. wide. Calif.—Very suitable for low moist situations. Most of the plants grown under this name are garden forms of *H. annuus.*

20. **lætiflòrus,** Pers. SHOWY SUNFLOWER. St. 4–8 ft. high, leafy and rough-hairy: lvs. 4–10 in. long, ovate-lanceolate, more or less serrate, rough on both sides: fls. several, 2–4 in. broad, short-peduncled; rays 15–25, about 1½ in. long, showy. Prairies, Ind., Ill., Wis. Gn. 45:372. G.M. 31:204.—A desirable helianthus. The garden form *H. semi-plenus* is better than the type. Resembles tall-growing forms of *H. rigidus,* but disk yellow.

21. **hirsùtus,** Raf. St. 2–4 ft. high, densely hairy: lvs. ovate-lanceolate, thick, very rough, pubescent and pale beneath: fls. several, 2–3 in. across; rays 12–15. July–Oct. Dry soils, Pa. to Ga., west to Wis. and Texas.

22. **tracheliifòlius,** Mill. Resembles *H. strumosus,* but st. and fl.-stalks usually rough-hairy and lvs. thinner, green on both sides: branches and fl.-stalks rough-hairy. Aug., Sept. Dry soil, Pa. to Wis.

H. ciliàris, DC. Fl.-heads large; rays bright golden-yellow; disk-florets dark brown. A pretty floriferous species. Texas, Ariz., Mex.—*H. coloradénsis,* Ckll. Allied to H. fascicularis and H. grosse-serratus: 6 ft., in clumps: sts. strict, reddish and glaucous: lvs. elongate-lanceolate, rough, margins remotely dentate, the upper ones alternate and the lower opposite: bracts of involucre very long and slender, long-ciliate at base: disk yellow, and rays bright orange. Colorado. Var. *Andrèwsii,* Ckll. Rays deep orange, much richer in color.—*H. macrophýllus sativus* of horticultural literature, with tubers edible and in taste resembling Jerusalem artichoke, is probably H. strumosus var. macrophyllus, Britt., or possibly H. giganteus var. subterosus, Britt. There are many forms of wild sunflower that may come into cult., through dealers in native plants. These should be sought in the regular manuals of botany. The genus allows of different botanical interpretations.

S. W. FLETCHER.
N. TAYLOR.†

HELICHRÝSUM (Greek for *sun* and *gold;* referring to the flower-heads). Syn., *Elichrysum. Compósitæ.* Old World herbs or shrubs, mostly African and Australian; some of them are grown for everlastings, being, with Helipterum, amongst the most important plants for that purpose; annuals and perennials.

Flower-heads large, solitary, with fls. of 2 kinds, the outermost ones with pistils only; involucre dry and chaff-like, the stiff overlapping scales glabrous, often colored; heads large, terminating the branches, normally yellow, but now varying into many colors in long-cult. forms.—Probably 400 species. Easily grown as hardy annuals in any garden soil but doing best in a rich loamy soil. Very few are grown in U. S., except *H. bracteatum.*

A. *Lvs. oblong or narrow: grown for everlastings.*

B. *Heads large, solitary.*

bracteàtum, Andr. Fig. 1799. Stout annual, 1½–3 ft. tall, somewhat branched, the terete sts. nearly or quite glabrous: lvs. many and rather large, oblong-lanceolate, narrowed to a short petiole, entire, green: heads terminating the branches, 1–2½ in. across, yellow or orange, the short and obtuse involucre-scales imbricated. Austral.—Perhaps the most important single everlasting fl. grown in this country, particularly for bold or heavy design work. It is very variable, particularly in color. R.H. 1896:551. The heads are pure white in var. **álbum,** Hort. (*H. álbum,* Hort. *H. níveum,* Graham. B.M. 3857); scales tipped with red in var. **bícolor,** Hort. (*Elichrysum bícolor,* Lindl. B.R. 1814); dark scarlet in var. **atrococcíneum,** Hort. (*H. atrococcíneum,* Hort.); dark blood-red in var. **atrosanguíneum,** Hort. The forms with very large heads are often known as *H. macránthum,* Hort. The double

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forms are often known as *H. monstrósum*, Hort. Other portraits of this species will be found in B.R. 24:58. R.H. 1851:101.

BB. *Heads medium to small, in clusters.*

C. *Color yellow or orange.*

arenárium, DC. YELLOW EVERLASTING. A foot or less high, herbaceous: lvs. plane, white-woolly, the lower ones oblong-obovate and long-attenuated into a petiole, the upper ones linear-lanceolate and acute: heads globular, in compact little corymbs, bright yellow. Perennial, in sand, France.—Apparently not cult. in this country. See *Everlastings*, p. 1183.

orientále, Gaertn. (*Gnaphálium orientále*, Linn.). St. simple, 1½ ft. or less tall: lvs. oval-oblong to lanceolate, obtuse, sessile, rather small: heads bright yellow, small, globular, in corymbs. S. Eu. to Asia Minor. G. 1:805.—Much cult. in Medit. regions, but little known in this country.

apiculátum, D. Don. Perennial, 1–2 ft., tomentose, leafy below: lvs. lance-spatulate, the base more or less spatulate: heads ½in. across, in small heads or clusters, orange-yellow, the scales sharp-pointed. Austral. —Little known in this country, and doubtfully hardy north of Philadelphia.

1799. Helichrysum bracteatum. One of the choicest everlastings. (×⅓)

CC. *Color white or nearly so.*

grandiflórum, Less. Perennial, somewhat woody, decumbent at the base: lvs. crowded near the base, sessile, obovate to oval or oblong, obtuse, woolly on both sides: heads hemispherical, in corymbose clusters, glossy, cream-color, ¼in. across. S. Afr.—Greenhouse plant north of Washington.

diosmæfólium, Sweet (*Ozothámnus rosmarinifólius*, Hort.). Tall, upright: lvs. very small, narrow-linear (½in. or less long), the margins revolute: heads small and numerous, white. Austral., sometimes grows 20 ft. high. Gn. 34:409; 55:222.—Cult. in S. Calif. by Franceschi.

AA. *Lvs. ovate or broader: border and vase plants.*

bellidioides, Willd. Slender-stemmed, trailing, nearly woody perennial: lvs. light green above, woolly beneath, ovate-spatulate, ¼–½in. long, flat: heads solitary, about ½in. diam., of the "everlasting" type; receptacle convex or nearly conical. New Zeal. G.C. III. 53:266, 436. Gn. 77, p. 253. G. 35:341. G.M. 56:286. —Not common in cult. but useful as a prostrate perennial; not hardy N.

húmile, Andr. (*Apheléxis húmilis*, Don). A low spreading, greenhouse perennial, with lvs. lacking tomentum, but sometimes woolly in the axils: lvs. round-backed, usually ⅛–¼in. long: scales of the involucre rosy. S. Afr.—A showy, but little-known species.

petiolátum, DC. (*Gnaphálium landtum*. Hort.). Tender perennial, cult. for its long, woolly sts. and woolly lvs., either as an edging in ribbon borders or as an ornament in lawn vases: lvs. petiolate, ovate and broad at the base, obtuse: heads (not often seen in cult.) in branched cymes, the involucre scales obtuse, cream-white. S. Afr.—An old garden plant. Prop. by cuttings from stock plants carried over winter.

H. Coóperi, Harvey. Bush with golden yellow fl.-heads. Afr.—*H. Guilélmii*, Engler. A robust perennial covered with white wool except the fl.-heads. E. Trop. Afr. B.M. 7789. Var. *Méyeri*, G.C. III. 31, p. 4, note. Fls. arranged more loosely.—*H. Selágo*, Benth. & Hook. f. Small, much-branched shrub: fl.-heads small, terminal, sessile, ¼in. across. New Zeal.—*H. Vólkensii*, O. Hoffm. Shrubby, with sts. and branches covered with white shaggy hairs: outer bracts bright rose, inner whitish and longer. E. Afr. G.C. III. 31:169, desc.

L. H. B.
N. TAYLOR.†

HELICÒDRA: *Billbergia.*

HELICODÍCEROS (Greek, *spirally 2-horned*). *Aráceæ*. Odd spathe-bearing plant, from a tuber, sometimes grown as pot specimens; odor offensive.

The extraordinary plant shown in Fig. 1800 is known as the "hairy arum" and sold by the bulb-dealers as *Arum crinitum*. When in flower it has a disgusting odor which attracts carrion flies and bright green insects as uncanny as the plant itself. The plant is the only species in its genus, the hairiness of the spadix being a very distinct character. Helicodiceros and Dracunculus are alike in having few ovules, which are fastened at the top and bottom of the cell, but in the latter the staminate and pistillate fls. are close together, while in the former they are separated by a sterile portion. Arum differs from both genera in having the ovules fastened in 2 series at the side of the cell. The lvs. of Arum are spear- or arrow-shaped, while in the other two they are pedately cut.

This plant is worth growing once, since it is one of the curiosities of horticulture. It may be secured from bulb-dealers in the autumn and flowered under glass in the spring. It is a most vile-smelling plant when in full flower. The plucky artist who drew the accompanying picture of this arum wrote at the bottom of his drawing, "Air 'em."

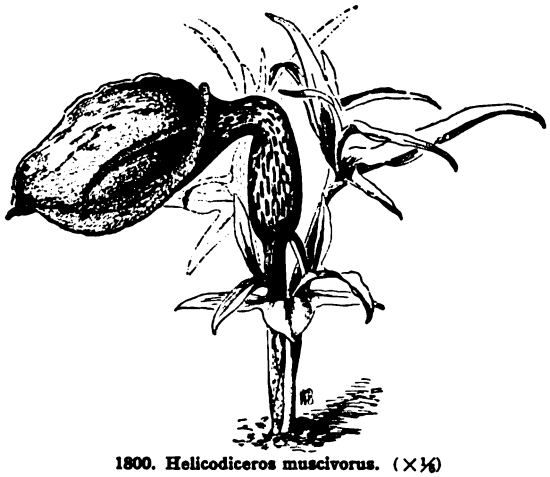
muscívorus, Engler (*H. crinítus*, Schott. *Árum crinítum*, Ait. *Dracúnculus crinítus*, Schott.). Fig. 1800. Height 1½ ft.: spathe-limb purple, covered with purple hairs. Corsica. B.R. 831. F.S. 5:445. G. 11:585; 19:515.

WILHELM MILLER.

HELICÒNIA (Mt. Helicon, in Greece, seat of the Muses). *Musáceæ*. Foliage plants allied to Musa, grown in a warmhouse along with alocasias, anthuriums and calatheas.

From Musa, Heliconia differs chiefly in having a dry,

often dehiscing, 3-loculed, 3-seeded fr.: fls. in clusters below the lvs., subtended by bracts after the way of Musa; sepals 3, linear, free or somewhat joined to the corolla; corolla short-tubed; stamens 5; staminodium 1: lvs. large and striking, often beautifully marked: sts. arising from a strong rootstock.—Perhaps 35 species in Trop. Amer., various of which have been intro. into cult., but the following are the only ones appearing in the American trade. Many species are being described from trop. Asia, and there is doubt about the American nativity of the genus. Some writers consider the Old World species as of the genus Heliconiopsis, which in the absence of evidence is not maintained here. For the botany of this very much perplexed genus, see



1800. Helicodiceros muscivorus. (×⅙)

Griggs, Bull. Torrey Club 30:640–664. Baker, Ann. Bot. 7:189–200. K. Schumann in Engler's Pflanzenreich, hft. 1 (1900). H. N. Ridley, G.C. III. 44:13.

A. *Bracts of the infl. ovate-acuminate, deeply boat-shaped.*

Bihâi, Linn. (*H. caribæa*, Lam.). Balisier. Wild Plantain. Becoming 10–15 ft. tall, banana-like: lvs. oval or oblong-oval, long-petioled, transversely ribbed, the blades 3–5 ft. long: blossom-sheaths very large, scarlet and black, the fls. red or orange. W. Indies and south. B.R. 374. L.B.C. 3:252.—A most striking plant, often seen in glasshouse collections. It is naturalized in the Old World tropics, and is the parent of many horticultural forms, of which the next two are almost surely examples.

aûreo-striàta, Bull. Perhaps a form of the preceding: lvs. beautifully striped along both midrib and transverse veins with golden yellow: sts. striped with yellow and green: lf.-limb oval-acuminate not decurrent: fr. ½in. long, obconic, orange. I.H. 29:464; 42, p. 289 (where a list of the best kinds will be found). S.H. 2, p. 133. F.R. 3:493. G.Z. 26, p. 123.—Very handsome. The best-known kind. Ridley considers this distinct from *H. Bihai*, but says he knows no native country for the species.

illústris, Bull. (*H. rùbro-striàta*, Hort.), is of the general style of the last, but the rib and veins are marked with pink and the lf.-bases are somewhat decurrent. Var. **rubricaûlis,** Hort., has more red, the petiole being bright vermilion; fr. red about ¼in. long. R.H. 1896:36 (where a review is made of the species). R.B. 21, p. 69. Gn. 52, p. 359. G. 20:369; 29:431. G.W. 2, p. 115; 7, p. 389.

AA. *Bracts of infl. lanceolate-acuminate, not boat-shaped.*

Michólitzii, Ridley. A very large plant forming large tufts: sts. 2 ft. or more tall, 3 in. across, pale green, marbled with gray: lvs. pale green, blade about 3 ft. long and about 1 ft. wide: infl. about 12 in. long on a hairy peduncle: rachis yellow, dotted with green: fls. 14 or more in each bract, the latter long-acuminate, white; sepals and petals acute, brownish; stamens slender, anthers linear: fr. orange, pear-shaped. New Ireland.—May not be a true Heliconia.

angustifòlia, Hook. (*H. bicolor*, Benth.). Dwarfer, whole plant not over 4 ft. tall: lvs. long and narrow, 1½–2½ ft. long, 3–6 in. wide, green: peduncle erect, glabrous; fls. yellowish green, 6–10 in each glabrous red bract. S. Amer. B.M. 4475.

H. insignis, Hort., intro. by F. Sander & Son in 1912, is of uncertain botanical origin. It is described as "with dark bronzy-green lvs." and may be some form of H. metallica, Planch., which is described as dark shining green and purple beneath when young. B.M. 5315.—*H. Léhmannii variegàta*, Hort., advertised by Royal Palm Nurseries, is of doubtful botanical position. It is described as "a stocky, broad-lvd. plant, somewhat resembling a miniature banana, with lvs. striped with creamy yellow, and having yellow sts."

N. Taylor.†

HELICOPHŸLLUM (*spiral leaf;* lateral segments of the pedatisect leaves sometimes twisted). *Aràceæ.* Nine or ten arisæma-like herbs of western Asia and delta of the Nile, of which one species may appear in collections; very little planted in the coolhouse, or in the open in mild climates with some protection.

Tuberous-rooted herbs, with radical lvs. and fls. appearing together: scape shorter than lvs., bearing a single inflorescence: spathe with an oblong tube and an erect or more or less hooded limb; spadix tailed, mostly included or short, the middle part with neutral fls.; apetalous; stamens 2; ovary 1, 1-celled, 2- or 4-ovuled: fr. an ovoid or globose berry. *H. Álberti,* Regel, is a stemless plant with a dark maroon-purple spathe 7 in. long: spadix 5 in. long, the appendix protruding and blackish purple: lvs. of young plants simple, oblong-lanceolate; of mature plants oddly divided, the "blade hastate, acuminate, undulate, concave at the base, with 2 lateral spreading horn-like horizontal basal lobes, and between them 2 long linear erect ones that are nearly as long as the blade, and face it; these front lobes have each on the outer margin below the middle a curved horn-like process." E. Bokhara. B.M. 6969. G.C. III. 36, suppl. Oct. 29.—Blooms in late spring, and requires protection.

L. H. B.

HELIOCÈREUS (*sun* and *cereus*). *Cactàceæ.* Procumbent plants with weak stems clambering over rocks and bushes.

Branches strongly angled: ribs usually 3 or 4, bearing clusters of spines from all the areoles: fls. diurnal, large and showy, with a short tube; petals elongated; stamens long and numerous, declined; ovary and fr. spiny.—The four species known all come from Mex. The species of this genus readily hybridize with species of Epiphyllum (Phyllocactus) and other related genera, giving rise to many horticultural varieties.

speciòsus, Brit. & Rose (*Cèreus speciòsus*, Cav.). Sts. freely branching at base, 1 in. diam., with a few aërial roots: spines in fascicles of 5–8, needle-like: fls. appearing from the older growth of the sts., 6 in. diam., remaining open for several days, purple-red: fr. 1½–2 in. long.

amecaénsis, Brit. & Rose (*Cèreus amecaénsis*, Heese). A recent introduction similar to the above, but with perfectly white fls. It is not common in this country, but is common in Eu.

J. N. Rose.

HELIÓPHILA (Greek, *sun-loving;* grows in the open country of the Cape). *Crucíferæ.* This genus includes a blue-flowered half-hardy annual that grows mostly a few inches high and is sometimes advertised in catalogues of flower seeds.

Heliophila contains about 80 species of annual and subshrubby perennials, natives of S. Afr. The transversely twice-folded cotyledons are an important character of the genus: other important generic characters

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are pods sessile or pedicelled, 2-celled, 2-valved, dehiscent: seeds in a single row, often winged: racemes long and leafless, and fls. yellow, white, rosy or sky-blue: lvs. various.

pilòsa, Lam. A very variable species, with st. 6–24 in. high, erect or diffuse, simple or unbranched from the base: lower lvs. often opposite, the rest alternate: fls. normally sky-blue, with a yellow center, but the natural varieties include lilac and yellow. The typical *H. pilosa* has a st. that is rough with spreading hairs: lvs. hairy, either oblong or linear, entire or sometimes lobed near apex, cuneate at base: pods linear, erect or spreading. Var. **incìsa,** Sonder, has lvs. linear-cuneate, 3-cut at the apex, rarely 5-cut, the lobes linear or acuminate. B.M. 496 (as *H. arabioides*). WILHELM MILLER.

HELIÓPSIS (Greek, *like the sun*). *Compósitæ.* Hardy herbaceous plants, bearing numerous yellow flowers in autumn.

Stem erect, loosely branching: heads yellow, long-stalked, borne in loose terminal or axillary panicles both radiate and discoid: lvs. opposite, petioled, 3-ribbed, oblong-ovate to ovate-lanceolate, coarsely toothed. Heliopsis has no pappus, while in Helianthus the pappus has 2 awns. In Heliopsis the rays have pistils, but may be fertile or sterile. In Helianthus the rays have no pistils at all.—About 10 species, all native of N. Amer. They are all perennials except one, and that is not cult. They are not common in gardens because of the more attractive forms in Helianthus. *H. helianthoides* var. *Pitcheriana,* however, deserves wider popularity. For cult., see *Helianthus.*

helianthoìdes, Sweet (*H. lævis,* Pers.). St. 3–5 ft. high: lvs. 3–5 in. long, thinnish, smooth on both sides or roughish above, opposite or sometimes in 3's: fls. numerous, 1½–2½ in. broad, long-stemmed. July–Oct. Open places, Canada to Fla., west to Ill. and Ky. B.M. 3372. Gn. 25, p. 237. Var. **Pitcherìana** (*H. Pitcherìana,* Hort.). A dwarf, more branching and bushy form, 2–3 ft. high, with a spread of 3–4 ft.: fls. produced much more freely than in the preceding and a deeper yellow. One of the best hardy plants for the perennial border, being especially valuable for cutting and for planting in dry places. A.G. 16:323. F.R. 2:259.

scàbra, Dunal. Differs from *H. helianthoìdes,* chiefly in being rough throughout: upper lvs. sometimes entire: heads few, often solitary. B.R. 592 (as *H. canescens*). Var. **gratíssima,** Hort. Fl.-heads large, brilliant pale yellow. Var. **imbricàta,** Hort. "A dwarf form with fls. 3 in. diam., golden yellow." Var. **màjor,** Hort. Larger in every way than the type. J.H. III. 33:359. Var. **zinniæflòra,** Hort. "A double form, there being several series of ligulate florets." R.H. 1908, p. 419. Dry soils, Maine to N. J. and west to Mo.

S. W. FLETCHER.
N. TAYLOR.†

HELIOTROPE: *Heliotropium.*

HELIOTRÒPIUM (heliotropic; *turning to the sun*). *Boraginàceæ.* HELIOTROPE. Popular glasshouse plants, prized for their flowers and fragrance.

Herbs or rarely shrubs, with small fls. in terminal, forking often scorpioid clusters and alternate simple lvs.: corolla short funnelform or salver-shape, the throat mostly open (sometimes constricted); stamens 5, attached to the tube, not exserted, the filaments very short; ovary 4-loculed and splitting into 4 nutlets (or two 2-loculed nutlets) when ripe, surmounted by a simple style.—Species upward of 250, in the warmer regions of the globe, many of them annuals. There is a heliotrope (*H. curassávicum,* Linn.) native to the U. S., from Del. and S. Ill. southward on seashores and in salty soils, with white or bluish fls. and oblong or linear lvs.; another species (*H. tenéllum,* Torr.) in open dry lands from Ky. to Kans. and southward, with white scattered or somewhat umbellate fls. and very narrow revolute lvs.; several species in the southern states and southward; also a naturalized species (*H. indicum.* Linn.) with bluish scented fls. and oval or ovate-rugose lvs.

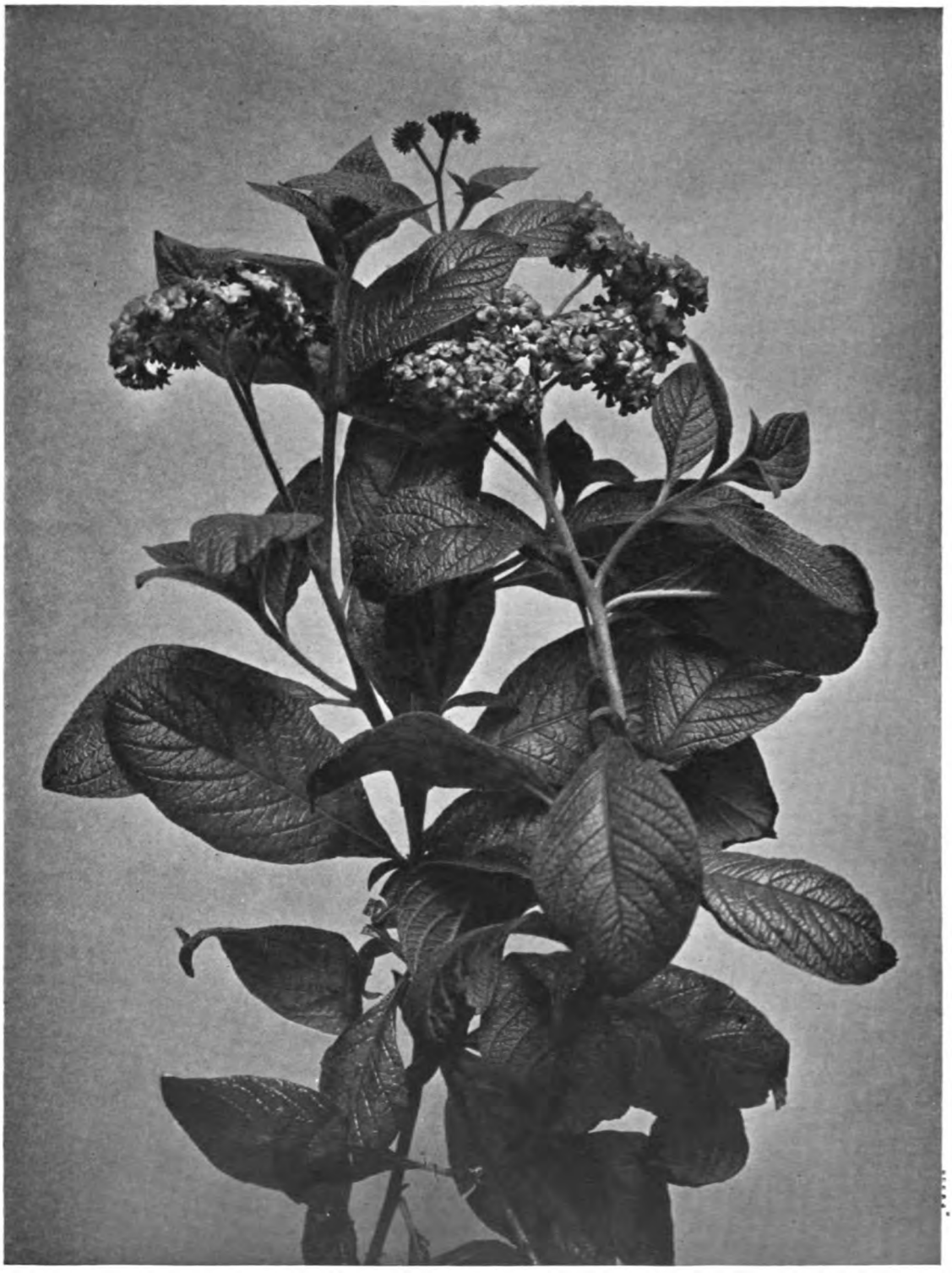
The garden heliotropes seem to be derived from 2 species. **H. peruviànum,** Linn., is perhaps the leading species. Fig. 1801. Lvs. oval or oblong-lanceolate, very veiny, not conspicuously narrowed at the base: fls. small, in a close cyme, the corolla-tube little longer than the calyx. Peru. B.M. 141. G. 8:252. Vanilla-scented. *H. regale* is a garden race of this, with very large clusters and fls. of variable color. Gt. 50, p. 163. **H. corymbòsum,** Ruiz & Pav. (*H. grandiflòrum,* Don), has longer and relatively narrower lvs., which are distinctly narrowed to the base, fl.-clusters larger and more open, fls. nearly twice larger and the corolla-tube nearly twice longer than the calyx; calyx-teeth longer and narrower. Peru. B.M. 1609. Narcissus-scented. Many of the large-trussed and large-fld. garden varieties are apparently of this species rather than of the former; or possibility the two are hybridized. Originally both species were violet-fld. but the colors are now in various shades of purple, and there are white-fld. forms. **H. Voltaireànum,** Hort., is a compact garden form, and said to be a hybrid. P.M. 16:100. Another species, **H. europæum,** Linn., is rarely seen in old collections, and it is sparingly naturalized. It is a hoary-downy annual herb 6–30 in. high, with long-petioled oval lvs., and white fls. in scirpioid racemes. **H. incànum,** Ruiz & Pav., of W. S. Amer., is perhaps in cult. as a greenhouse shrub: 2–3 ft.: lvs. thick, ovate, crenulate, more or less silky, hoary beneath: fls. white, in forking spikes, the corolla twice exceeding the calyx. Var. **glàbrum,** G.C. II. 22:809, has lvs. rough, nearly destitute of silky covering, broader and more ovate, a denser infl., a larger and more hairy calyx and purple fls. **H. anchusæfòlium,** Poir., of Brazil to Argentina, is said sometimes to be found in gardens and it is recorded as spontaneous in parts of this country; it is odorless: perennial, with 4-angled hispid st.: lvs. lanceolate to linear-lanceolate, sessile, entire: fls. violet, about ¼in. across. B.M. 8480.

L. H. B.

1801. Heliotropium peruvianum. (×½)

Heliotrope, apart from its use as a border plant and for bedding, being a universal favorite, usually forms part of the stock in trade of florists who do a local business, ranking next to the geranium as a pot-plant for spring trade. For cut-flowers in winter it is equally popular, but its lasting qualities when cut are uncertain. Successful growers think that for best results, strong stems and good keeping qualities, it should be grown in a moderately cool, airy house. Some of the best are grown in a house suited to violets and mignonette, where the temperature seldom rises to 50° F. at night.

Stout, soft cuttings make the best plants, and root easily in a temperature of 60° F. From the time they are inserted, sufficient water must be given to prevent wilting. A propagating-bed is not required. Ordinary flats will do—the medium half-leaf soil and sand. They must be well shaded for a week or so. They are very liable to the cutting-bench fungus, and should be potted or boxed off as soon as rooted, which should be in ten or twelve days. Any light soil will do, and it need not be rich for the first shift.



LII. Heliotrope, an old-time favorite.

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For winter flowers, cuttings may be taken in July and treated as above. Some of the plants among the spring batch with straight stems may be grown along for standards by taking out the side shoots until 2 feet high. These make handsome drooping specimens. By pruning about midsummer they may be kept in good condition for years.

Heliotropes may be grown in the same pots for several years, by using fairly rich top-dressing or weak liquid manure in growing season.

Stock intended for spring cuttings is better grown continuously in pots, as the plants lift badly in the autumn. A few left-over bedding-plants may be grown along in pots, purposely for stock. As a matter of fact, stock taken from these pot-plants root more readily than those taken from plants grown outdoors. A good plan is to prune them rather closely a few weeks before the time for taking cuttings comes, say in January. In this way we secure an even lot of cuttings, and all at one time.

Heliotrope is extensively used as a bedding-plant, is a favorite in window-gardens, and is much grown by florists for cut-flowers. The ease with which it may be grown either in pots or the garden, the color and fragrance of its dainty flowers, and the continuity of bloom, have all contributed to make it a general favorite.

There have been numerous garden varieties and a number of hybrids—white and the different tints of blue predominating. Floral catalogues rarely mention, however, more than six to eight varieties. Madame de Blonay has been a favorite white for years, while Queen of Violets is perhaps the finest of the blues. Chieftain is a lighter tint. Albert Delaux is a variety with golden variegated foliage, but variegated heliotropes are undersirable. Among seedlings double forms occasionally appear. They have no special merit, and are seldom perpetuated. T. D. HATFIELD.

HELÍPTERUM (Greek for *sun* and *wing;* said to refer to the light-plumed pappus). Including *Acroclinium* and *Rhodánthe*. *Compósitæ*. Half-hardy annual or perennial herbs cultivated as everlastings or immortelles.

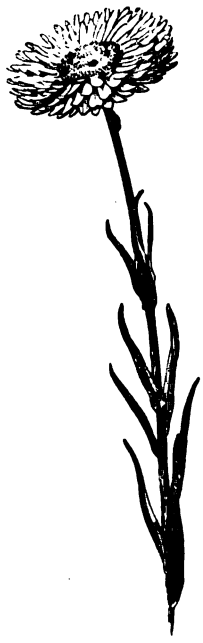
Flowers mostly perfect, with 5-toothed open corollas: achenes woolly, bearing a pappus of many plumose bristles: involucre glabrous, obovate or top-shaped, silvery or rose-colored: plants mostly glabrous.—About 60 species in Austral. and S. Afr. This and Helichrysum, from which it is distinguished by its plumose not roughened pappus-hairs, are amongst the most important of everlasting fls. The cult. kinds are annual herbs (or grown as such), of easiest cult. in any garden soil.

1802. Helipterum Manglesii. Generally known as Rhodanthe. (×⅓)

A. *Heads large, many-fld.*

B. *Lvs. broad.*

Mánglesii, Muell. (*Rhodánthe Mánglesii*, Lindl. *Roccárdia Mánglesii*, Voss). Fig. 1802. Neat glaucous annual, 12–18 in. tall, with very slender, long pedicels, bearing pretty nodding showy heads: lvs. thin, oval or elliptic, clasping: involucre silvery-chaffy, the ray-florets originally clear handsome pink, but now varying to white (*R. álba*, Hort.), and to dark red (*R. atrosanguínea*, Drumm.). R.H. 1852:141. Var. **maculàtum** (*R. maculàta*, Drumm. *Roccárdia Mánglesii* var. *maculàta*, Voss), is usually larger, with shorter lvs. and involucre flecked with red: rays pink or white. Austral. F.S. 22:2291. B. R. 1703.—A charming plant, and one of the few everlastings which retains much of its grace and beauty after being dried. There are double-fld. forms, i.e., those with all or nearly all the florets ligulate. Excellent also for pot culture. Seeds of the mixed varieties are sometimes sold under the name *Rhodanthe varius*.



1803. Helipterum roseum. (×½)

1804. Helipterum Humboldtianum. (×½)

BB. *Lvs. linear.*

ròseum, Benth. (*Acroclínium ròseum*, Hook. *Roccárdia ròsea*, Voss). Fig. 1803. Annual, 1–2 ft. high, glabrous, with many strict simple branches from the crown, each st. terminated by one large head: lvs. numerous, alternate, small and linear: rays many, pointed, bright pink (or varying to white in *H. álbum*, Hort.). Austral. B.M. 4801.—A serviceable plant.

AA. *Heads small, clustered.*

Humboldtiànum, DC. (*H. Sánfordii*, Hook. *Roccárdia Humboldtiàna*, Voss). Fig. 1804. Annual (or cult. as such), erect or with a decumbent base, the sts. somewhat branching: lvs. (and sts.) white-tomentose, at least when young, linear or lance-linear, pointed, alternate: heads small, oblong, yellow, in a dense terminal corymb.. Austral. B.M. 5350. V. 3, p. 160.

corymbiflòrum, Schlecht. (*Roccárdia corymbiflòra*, Voss). Annual, lower than the last, more branchy: lvs. broader: heads 2–3 times larger, top-shaped, in small corymbs, the prominent rays white. Austral.

L. H. B.
N. TAYLOR.†

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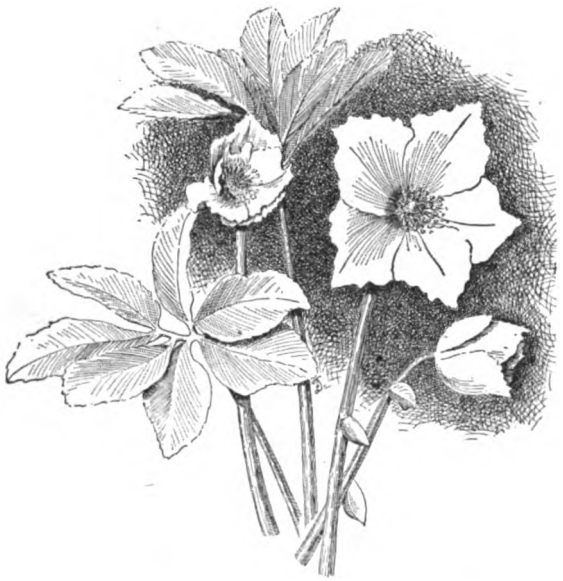
HELLÉBORUS (ancient name of *H. orientalis*, meaning unknown). *Ranunculàceæ*. HELLEBORE. Hardy herbaceous perennials, admired for their very early flowers and also their attractive leaves.

Erect, with large palmately divided lvs., the basal long-petioled, the upper sessile and sometimes reduced to bracts: fls. large, white, greenish, red, purple, or yellowish; sepals 5, broad, petal-like, mainly persistent; petals small, tubular, furnished with claws; stamens many: carpels 3–10, sessile, forming leathery, many-seeded caps., dehiscent at the apex.—About 8 species, natives of Eu. and W. Asia. Monographs by J. G. Baker in G.C.II. 7:432 (1877) and by Thos. Moore in G.C. II. 11:431 (1879).

All the kinds will thrive in ordinary garden soil, but for the best results use a soil of rich loam and coarse sand, with a top-dressing of rotten manure. A moist, well-drained, partially shaded situation is preferable. The species may be planted in shrubbery borders, and in rockeries, or if wanted for cut-flowers they should be planted in beds. An important point is not to disturb the plants when once established, as they are very sensitive to frequent changes of location. All the



1805. Christmas rose, Helleborus niger. (×⅓)

species bloom before spring arrives; a few mild days in December or January will bring out the buds and flowers of *H. niger* varieties, and the others are not far behind. White hellebore is not of this genus: see *Veratrum*.

They are easily forced under glass. Strong plants should be taken up into large pots and gradually inured to a warm temperature. Blossoms may thus be brought forth at any time desired in winter. Propagation is best by division of roots in fall or spring. Gardeners prefer to divide the roots in late summer or fall, as this does not come at the flowering season. If seeds mature they will germinate well if planted immediately in boxes or in rich, open ground. Seedlings should bear flowers the third season.

A. *Lvs. dying annually, thin.*

víridis, Linn. St. scapose: rootstock creeping: 1 basal lf. 8–12 in. broad, on petiole 6–10 in. long; segms. 7–11, oblong, acute, sharply serrate: fl.-st. hardly exceeding the basal lf., bearing 3–6 fls. and large, lf.-like bracts: fls. large, yellowish green; sepals broadly oblong, obtuse, spreading: caps. about 4, as long as the sepals, transversely ribbed; style erect. Eu. Naturalized in eastern states. G.C. II. 25:553.—Not so much used as the other species here given. Var. **purpuráscens,** Waldst. & Kit. Differs chiefly in the central lf.-segms. being deeply palmately cleft, and the fls. much tinged with purple, especially on the outside. Hungary. B.M. 3170.

AA. *Lvs. evergreen, coriaceous.*

B. *Fl.-st. never more than once forked; fls. 1 or 2.*

níger, Linn. CHRISTMAS ROSE. Fig. 1805. Stemless: rootstock short, black: only 1 lf. somewhat irregularly divided into lobes, toothed on the outer half; petiole 5–7 in. long: fl-st. simple or once branched; fls. very large; sepals white, or flushed with purple: caps. 6–8. Rocky places, Eu. B.M. 8. Gn. 55, p. 13. J.H. III. 51:591; 61:583. G.W. 10, p. 245. Gn.M. 8:279. G. 27:534. C.L.A. 9:288. Var. **angustifólius,** Hort. (var. *minor*, Hort.). Plant and lf. similar, but fls. small. Very pretty. G.C. II. 21:85, and III. 21:19. G.M. 50:933. G.W. 2, p. 230. Gn.W. 23:45. Var. **altifólius,** Hayne (var. *májor*, Hort. Var. *máximus*, Hort.). Petiole reaching 1 ft. long: fls. the largest in the genus, 3–5 in. across, and often several on same st. Gn. 14:178; 48:6. G.C. II. 20:693. A.G. 11:63; 21:41. G. 1:657; 8:537; 11:395; 6:367; Var. **præcox,** Hort. Fls. smaller than in type, from Sept. to Feb.

BB. *Fl.-st. forked 2 or 3 times; fls. several or many.*

C. *Without lvs. on st. below infl.*

orientàlis, Lam. Stemless; short creeping rootstock: 1 radical lf., 7–9-lobed; segms. 6 in. long, 1½–2 in. broad, acute, serrate in the outer half, pubescent, with strongly raised veins beneath; petiole 1 ft. long: fl.-st. over 1 ft. high, forked above, 2–6-fld., large, lf.-like bracts; sepals roundish, imbricated, white, purple beneath and purple edges, spreading: caps. oblong, shorter than the sepals, transversely ribbed; style erect or incurved. Asia Minor. Gn. 47, p. 136. G. 18:79.—There are numerous varieties of this beautiful species.

Purple-fld. varieties of H. orientalis.

Var. **cólchicus,** Regel. St. purple-spotted, quite glaucous: 1 lf. to each fl.-st.: fls. 3–6 on a st., deep bright purple, both inside and out. Asia Minor. B.M. 4581. J.F. 2, pl. 140 (both as *H. atrorubens*). Gt. 1860:293. Var. **cólchicus-punctàtus,** Moore. Fls. deeper plum-purple, more glaucous, exquisitely mottled inside with innumerable dark dots. Gn. 16:60, f. 8.—One of the handsomest of all the hellebores.

Var. **abchásicus,** A. Braun. Much like var. *Colchicus*, but differing in having 2 or more lvs. to a fl.-st. Caucasus region. Gt. 1866:496 (as *H. caucasicus* var. *abchasicus*, Regel).

Var. **atrórubens,** Waldst. & Kit. Only 1 lf. on a fl.-st. glabrous, thinner in texture than in the rest of the orientalis group: segms. narrow: fls. 2–4 on a st.; sepals dark purple outside, greenish purple within. Hungary. R.H. 1865:231.—A connecting link between the viridis and orientalis groups.

Var. **rùbro-purpùreus,** Hort. (*H. atropurpùrea*, Hort.). A seedling of var. *atrorubens*, with bold foliage and purple fl.-sts.: fls. spreading, deep purple. Characters well fixed and very handsome. Gn. 16:60, f. 1. R.H. 1884:564.

Purple-fld. hybrids of the varieties of *H. orientalis* are found in the trade under the following names: Var. *elegans;* var. *iridescens; F. C. Heinemann*, fls. very large, imbricated, deep purple and mottled; *Frau Irene Heinemann*, fls. rose-purple outside, greenish white, with dark lines and dots inside; *Gretchen Heinemann*, red-fld., strong grower; *Hofgarten-Inspector Hartwig*, fls. rose-purple without and greenish within; *Apotheker Bogren*, rose-purple, very large.

White-fld. varieties of H. orientalis.

Var. **olýmpicus,** Lindl. Glabrous: fls. small, but spreading, very numerous; sepals green on outer surface, white within. Bithynia. B.R. 28:58.—Hybrids closely allied to this have been given the trade names: Willy Schmidt and Prof. Dr. Schleicher.

Var. **guttàtus,** A. Braun. Glabrous, green st.: sepals green outside, white within and elegantly spotted with purple-crimson dots. Caucasus region.—Two allied hybrid forms are named: Commerz Benary and Albin Otto. Gn. 16:60, f. 4. G.M. 54:73.

Var. **antiquòrum,** A. Braun. Glabrous, green mottled st.: fls. as in var. *olympicus,* but more imbricated, maintaining the bell-shaped form. B.R. 28:34 (as *H. orientalis,* Lindl.). Gn. 16:60, f. 3.

Green-fld. variety of H. orientalis.

Var. **caucásicus,** A. Braun. Lvs. very glossy; segms. more oblong than in the type, often 3 or 4 in. broad: sepals round, pale green, much imbricated. Caucasus region. G.M. 51:873. Gn.W. 24:44.

cc. *With lvs. on st. below infl.*

fœtidus, Linn. True st. 1 ft. high, marked with lf.-scars near the base: lvs. coriaceous, with petioles 3–6 in. long: fl.-st. branched low down; sepals green or bordered with bright purple, under 1 in. long, stamens of same length. Fls. in late winter and early spring. W. Eu.

H. córsicus, Willd. (H. lividus, Auth.). Lvs. trifoliate, dirty yellowish green in color; lfts. broad-ovate, sharply toothed on margins. Blooms March to April. Corsica, Sardinia.—*H. lividus,* Ait. Under cult. a robust plant with thick, fleshy sts.: radical lvs. simple, cordate; cauline trifoliate: fls. 2½ in. across, dull purple-gray, tinged with green, nodding, in panicles of 6–8. Balearic Isls. B.M. 72; 7903. G. 27:422.

K. C. Davis.

HELÒNIAS (Greek, referring to swamp). *Liliàceæ.* Swamp-Pink. Stud-Pink. A hardy perennial bulbous plant in wet places from northern New Jersey to North Carolina and is sold by dealers in native plants for bog-gardening.

Rootstock stout and tuberous: scape hollow, bracted, bearing at the top a short dense spike of rather showy purple fls.: segms. 6, persistent; stamens 6: caps. obovoid, 3-lobed, dehiscent above.—One species.

bullàta, Linn. Lvs. several or numerous, thin, dark green, clustered at the base of the scape, 6–15 in. long, ½–2 in. wide, with fine parallel nerves: scape stout, bracted below: in very early spring it bears a hollow scape 1–2 ft. high, crowned by a raceme 1–3 in. long, composed of perhaps 30 pink or purplish fls., each ½ in. across, 6-lobed, and with 6 blue anthers. B.M. 747. L.B.C. 10:961. B.B. 1:402.—Helonias, which is perfectly hardy, is so easily prop. by division that it is hardly worth while to grow from seed. Under cult., also, it seems rarely to mature perfect seed. It multiplies itself rapidly from offsets, a single plant often providing a dozen others in a season. It is found growing in dense shade and also in the full glare of the sun, always in wet sphagnum bog in the latter case, while in the shade it sometimes spreads to dry ground. Although one of the showiest of all American bog-plants, it is comparatively little known here, though better in England. It makes an elegant pot-plant.

Harlan P. Kelsey.
Wilhelm Miller.

HELONIÓPSIS (Greek, *like Helonias*). *Liliàceæ.* Herbaceous plants resembling the swamp-pink, *Helonias bullata,* in the color of flowers, but the flowers are larger and fewer, and the leaves numerous and tufted.

Scapose plants, with fls. few in a raceme or sometimes solitary: style a conspicuous feature, being long and red, tipped with a purple undivided stigma, while in Helonias the style is very short and 3-cut. Both genera are separated from numerous allied genera by the septicidal dehiscence of their caps. The fls. are bell-shaped, drooping, deep pink, 6-lobed, with 6 red filaments and purple-blue stamens.—The genus has about 4 species in Japan and Formosa.

japónica, Maxim. Rootstock short, stout, with long root-fibers: lvs. oblanceolate, persistent, green tinged brown or purple: fls. pink or rose-colored, on rather long pedicels, in few-fld. racemes: seeds small, very numerous, with a conspicuous tail at each end. Japan. B. M. 6986.—It grows in the mountains of Japan at an altitude of 2,000–7,000 ft., and is presumably hardy.

breviscàpa, Maxim. (*H. grandiflòra,* Franch. & Sav.). Rootstock præmorse, thick and short: radical lvs. spatulate, acuminate; scape-lvs. short: pedicels very short; perianth blush-white, the segms. obovate; style and stamens scarcely exserted: seeds appendaged. Japan. G.C. III. 37:178. Gn. 68:52.—Recommended in England for early spring bloom and hardy; requires a damp and shady position.—Entire plant 6–8 in. high.

H. umbellàta, Baker, from Formosa, has oblanceolate mucronate lvs., st. 3–5 in. high, and 3–10 fls. in an umbel, the segms. obtuse and scarcely 1 line wide.

L. H. B.

HELWÍNGIA (after G. A. Helwing, 1666–1748, a German clergyman, who wrote on the botany of Prussia). *Araliàceæ.* A curious deciduous shrub, remarkable for the reason that the small, inconspicuous greenish flowers are borne in clusters on the midribs of the leaves at about the center of their upper surfaces.

Flowers dicœcious, short-pedicelled, with obsolete calyx, 3–5 petals and stamens and 3–4-celled ovary: fr. a berry-like, 3–4-seeded drupe.—Two species in Japan and Himalayas. Of not much decorative value and therefore rarely cult., but interesting on account of the unusual position of the fls.; hardy as far north as Boston. It seems to grow in any soil that is somewhat moist. Prop. by greenwood cuttings under glass.

japónica, Dietr. (*H. rusciflòra,* Willd.). Bushy shrub, 3–5 ft. high: lvs. petioled, ovate or elliptic-ovate, acuminate, serrate, stipulate, 1½–3 in. long: fls. in June, the staminate generally with 3, the pistillate with 4 petals. Japan. S.Z. 86. A.G. 13:8.

A. Phelps Wyman.

HELXÌNE (from the Greek to *tear,* because the seeds catch on the clothes). *Urticàceæ.* A small creeping herb with filamentous branches: lvs. alternate, small, entire, roundish: fls. monœcious, pistillate in the axils of the lower lvs., staminate in axils of upper. One species, *H. Soleiròlii,* Req., from Corsica and Sardinia. Sts. slender, reddish: lvs. bright green, cordate-reniform: fls. inconspicuous.—A good plant for the alpine garden, to be grown in moderate shade.

HEMEROCÁLLIS (Greek, *beautiful for a day;* because the blossoms fail at night). *Liliàceæ.* Yellow Day Lily. Popular yellow- and orange-flowered stout-rooted glabrous perennials with abundant radical foliage, prized for their hardiness and the showy bloom in spring and summer.

Erect with more or less branching scapes overtopping the long keeled lvs. which are both radical and 2-ranked at the base of the scape: fls. lily-like, mostly horizontal or oblique; tube short, inclosing the ovary; segms. 6, much exceeding the tube, oblong or spatulate; stamens 6, inserted in the throat, declined, the filaments slender, the style simple; ovary oblong, 3-celled, becoming a loculicidally 3-valved caps.: seeds black, spherical.—Species about a half-dozen, Eu. to Japan.

Hemerocallis includes the lemon lily (*H. flava*), one of the hardiest and best of herbaceous perennials. All the blue and white day lilies belong to the genus Hosta; all the yellow and orange day lilies belong to Hemerocallis. The yellow day lilies have narrow, grass-like foliage, and their flowers have wider funnels; the blue and white day lilies have very broad foliage, which is not at all grass-like. The plants are all remarkably free

from enemies, and need no protection of any kind, even in the severest winters. The roots are bundles of fleshy tubers, and are sometimes classed with bulbs in catalogues of nurserymen. Small plants will bloom the first year from the nursery. Clumps can often be left undivided for four or five years without loss in size or number of flowers, but as a general thing all robust-growing herbaceous perennials should be divided frequently. In old clumps the roots often become firmly matted

1806. Hemerocallis flava.

near the middle, and the wasteful competition between the too-numerous roots weakens the vitality of the plant and the flowers are likely not to be good. Next to *H. flava*, the oldest garden favorites among the yellow day lillies is *H. fulva*, sometimes called brown day lily, and erroneously in some catalogues the lemon lily. *H. fulva* is a taller plant, with later and orange-colored flowers and wavy inner segments. *H. aurantiaca* has come into prominence, and its var. *major* by some connoisseurs is considered the finest of all day lilies. As a rule, double forms are not so popular as the types, and they lack the simplicity and definite character of the single flowers. Yellow day lilies have a wholesome fragrance. The individual flowers are short-lived, but there is a good succession. The plants thrive in almost any garden soil, but are most luxuriant along the borders of ponds or moist places, and in partial shade. The flowers are excellent for cutting. Plants propagated by division. R. B. Whyte gives the succession of bloom at Ottawa, Canada, as follows: *H. Dumortierii*, June 4; *H. minor*, *H. Middendorfii* and *H. Thunbergii*, June 11; *H. rutilans*, June 18; *H. fulva*, July 2; *H. aurantiaca* var. *major*, July 9; *H. fulva* var. *Kwanso*, July 23, and *H. disticha fl.-pl.*, July 30. The common species, particularly *H. fulva*, often colonize about yards, and along roadsides, sometimes making great areas of foliage and very little bloom. There are several worthy hybrids in cultivation in the choice collections of plants (see supplementary list).

INDEX.

aurantiaca, 8.
citrina, 5.
crocea, 6.
Cypriani, 9.
disticha, 9.
Dumortierii, 7.
flava, 1.
flore-pleno, 7, 9.
fulva, 9.
graminea, 6.
graminifolia, 6.
hupehensis, 9.
Kwanso, 9.
longituba, 9.
luteola, 3.
maculata, 9.
major, 3, 8.
Middendorffii, 4.
Minor, 6.
pallens, 3.
rutilans, 7.
Sieboldii, 7.
Thunbergii, 2.
variegata, 9.

A. *Group of yellow-fld. species: fragrant.*

1. **flàva,** Linn. Lemon Lily. Fig. 1806. Lvs. 18–24 in. long, 6–8 lines wide: scapes longer than the lvs.; corymb 6–9-fld.; pedicels 12–24 lines long; tube 6–15 lines long. Eu., Temp. Asia. B.M. 19. A.G. 17:437; 24:363. Gn. 48, p. 400. G.W. 8, p. 277.—Blooms in June in the N. U. S.

2. **Thúnbergii,** Baker. Except for its later flowering, according to Baker, this species does not differ materially from *H. flava:* lvs. 6–7½ lines wide: corymb loose, 8–10-fld., with 1 or 2 fls. lower down; tube nearly 1 in. long; fls. lemon-yellow, opening widely, 3 in. across; segms. membranous, crisped. Japan. Intro. 1890.—Said to differ from all others in having the upper 6–10 in. of the scape thickened and flattened.

3. **lutèola,** Hort. Hybrid of *H. aurantiaca* var. *major* × *H. Thunbergii:* fls. golden-yellow, 6 in. across, on stout branching sts. 4 ft. high. Midway between parents in habit and in size of bloom. G. 25:346.—Raised at Colchester Nurseries, England. There is a var. **màjor,** Hort., large. Var. **pállens,** Hort., is a hybrid between *H. citrina* and *H. luteola:* vigorous, many-fld.: fls. large, fragrant, canary-yellow.

4. **Míddendorffii,** Traut. & Mey. Height 1–1½ ft.: lvs. 15–18 in. long, 8–12 lines wide: scapes about as long as the lvs.; corymb 2–4-fld.; pedicels almost none; tube 5–6 lines long; inner segms. 9–12 lines wide. Amur region. Gt. 522. R.H. 1897, p. 139.

5. **citrìna,** Baroni. Fls. lemon-yellow or pale sulfur-yellow: differs from *H. minor* in the lvs. being twice as broad and the fls. much larger; from *H. Dumortierii* in having a longer scape and lvs. three times as long, and fls. twice the size and longer-tubed. China.—Tall-growing, very fragrant; considered to be a fine species; excellent for cutting.

6. **mìnor,** Mill. (*H. graminea*, Andr., not Schlecht. *H. graminifòlia*, Schlecht.) Fls. golden-yellow: lvs. 15–18 in. long, 2–3 lines wide, darker green than in the other species: scapes about as long as the lvs.; corymb 3–6-fld.; pedicels 3–24 lines long; inner segms. membranous and wavy at the margin. July, Aug. N. and E. Asia. B.M. 873. Var. **cròcea,** Hort., is saffron-yellow.

AA. *Group of orange-fld. species: the last not fragrant.*

7. **Dumortièrii,** Morren (*H. rùtilans*, Hort. *H. Sièboldii*, Hort.). Height 1½–2 ft.: lvs. 12–15 in. long, 6–8 lines wide: scapes hardly as long as the lvs.; corymb 2–3-fld.; pedicels 3–6 lines long; fls. 2–2½ in. long, while they are 3–4 in. long in the other species; inner segms. 5–6 lines wide; tube very short. Japan. B.H. 2:43. Gn. 31:280. Var. **flòre-plèno** is less cult.—This species is the earliest to blossom. This species is confused; some authors consider it to be a form of *H. minor*.

8. **aurantìaca,** Baker. Height 2½–3 ft.: lvs. more than 12 lines wide: corymb 6–8-fld.; fls. bright orange, opening less widely than any other species, fragrant. July. Japan or E. Siberia (?).—The type was intro. to cult. in 1890 and has rapidly given way to var. **màjor,** Baker, intro. 1895, which is larger in all parts. Lvs. 12–18 lines wide: tube 9 lines long; fls. when expanded 5–6 in. across. July–Sept. Japan. G.C. III. 18:71. Gn. 48:400; 50, p. 17. J.H. III. 31:157. A.G. 18:179. —Closest to *H. Dumortierii*, from which it is chiefly distinguished by its much larger, later and more reddish fls. with longer tube.

9. **fúlva,** Linn. (*H. disticha,* Donn). Lvs. 18–24 in. long, 9–15 lines wide: corymb 6–12-fld.; fls. orange; pedicels short; inner segms. with wavy margins, with numerous veins joined by cross veins. July, Aug. Eu., Temp. Asia. B.M. 64 (central band of white). Mn. 5, p. 193. Var. **Kwânso,** Hort. (*H. Kwânso,* Hort.), the "double orange lily," blooms longer than any single-fld. form. Gt. 500. It has a sub-variety with variegated lvs. Var. **maculàta,** Baroni. Fls. with a red-purple blotch inside. China. Var. **longitûba,** Hort. Perianth-tube half as long as segms. Gt. 34:1187. Japan. Var. **flòre-plèno,** Hort., is shown in F.S. 18:1891, with a red spot on the middle of each segm. Gn. 48, p. 401. R.H. 1897, p. 139. Var. **variegàta,** has a stripe of white down the middle of each lf. Var. **hupehénsis,** Hort. Fls. very bright coppery red, with yellow throat; segms. undulate, reflexed. China. Var. **Cypriàni,** Hort. Dwarfer and more floriferous than the type: fls. coppery red with golden center and a golden line in the middle of the segms. China.

H. Barònі, Hort. (H. Thunbergii × H. citrina). Pale yellow; segms. narrow and pointed.—*H. coròna,* Hort. (H. flava × H. aurantisaca var. major). Floriferous, golden yellow.—*H. elménsis,* Hort. (H. minor and H. citrina).—*H. Flórham* is said to be a variety of American origin, with large golden yellow fragrant fls. in June and July. *H. Fórrestii,* Diels, recently intro. from W. China, is allied to H. fulva, but readily distinguished by its narrow perianth which has a remarkably short tube: fls. deep reddish orange: lvs. 8–14 in. long and ⅜ in. or less broad.—*H. fulcitrina,* Hort. (H. fulva var. maculata and H. citrina).—*H. hippeastroides,* Hort. (H. minor var. crocea and H. Thunbergii.)—*H. Muëlleri,* Hort. (H. Thunbergii and H. citrina).—*H. ochroleùca,* Hort. (H. Thunbergii and H. citrina). Pale primrose-yellow.—*H. vomerénsis,* Hort. (H. Thunbergii and H. minor var. crocea).

WILHELM MILLER.
L. H. B.†

HEMIÁNDRA (*half anther* or *male,* referring to the 1-celled anthers). *Labiàtæ.* Three shrubs or subshrubs in W. Austral., with opposite, rigid and narrow entire sharp-pointed lvs., and solitary axillary white or pink fls.: corolla with a short erect broadly 2-lobed upper lip, and a longer spreading 3-lobed lower lip with the middle lobe often 2-lobed; stamens 4, didynamous; style briefly 2-lobed, *H. pìngens,* R. Br., is recorded in European horticultural literature: rigid shrub, 1–2 ft. or less, glabrous or nearly so: lvs. sessile, linear or linear-lanceolate, with 1 or 2 prominent veins beneath: fls. white or pink with darker spots; corolla-tube exserted and dilated. J.F. 2:126.—Mentioned as a greenhouse subshrub.

L. H. B.

HEMICŸCLIA (Greek, *semi-circular,* referring to the seed-scar or the half-circular stigma). *Euphorbiàceæ.* Shrubs or trees, one cultivated in southern California for its holly-like leaves and red fruits.

Leaves alternate, simple, entire, leathery: fls. diœcious, in axillary clusters or the pistillate singly; sepals of the staminate fls. 4–5, imbricate, sometimes somewhat petal-like, petals none; stamens numerous from a disk; stigma sessile, broad, flat; 2 ovules in the single cell: fr. a 1-seeded, indehiscent drupe.—About 9 species of E. Indies to Austral. Related to Drypetes and Putranjiva. *H. australasica* is distinguished from the other 2 Australian species by its very short filaments and glabrous ovary.

australàsica, Muell. Arg. Lvs. broadly ovate to ovate-oblong, obtuse, 1½–3 in. long, finely veined below: fr. nearly ½in. long, very smooth, red and succulent, inclosing a stone.

J. B. S. NORTON.

HEMÍGRAPHIS (*half written,* of some obscure or fanciful application). *Acanthàceæ.* Diffuse or prostrate, mostly herbs, grown for foliage and fls. The genus, comprising perhaps 30 species in Trop. Asia, China, Japan and the Philippines, is allied to Strobilanthes and more remotely to Ruellia. From the former it is distinguished by the 3–∞ ovules in each cell, linear caps. with base scarcely constricted, and in the prostrate or trailing habit. Fls. in short terminal crowded spikes, the bracts usually herbaceous and imbricated; calyx deeply 5-cut; corolla slender-tubed with 5 rounded more or less unequal lobes; stamens 4, didynamous: lvs. opposite, simple, entire or dentate. **H. colorà̀ta,** Hallier (*Ruèllia colorà̀ta,* Blume; once listed as *Amaglyptus*), from Java, is a name listed in S. Fla., as a good subject for baskets and for cover: lvs. of *H. colorata* are ovate, shallowly cordate at base, crenate and bullate, purplish: fls. white or whitish, about ¾in. long. There is likely to be confusion in the trade plants in this and related groups.

L. H. B.

HEMIONÌTIS (Greek, *mule;* the plants erroneously supposed to be sterile). *Polypodiàceæ.* A group of small tropical ferns, with copiously netted veins and naked lines of sporangia following the veins. Eight or 9 species occur in the tropics of both hemispheres. The plants are dwarf, and are grown in Wardian cases by a few fanciers in the Old World. For cult., see *Ferns.*

palmàta, Linn. STRAWBERRY FERN. Fig. 1807. Lf.-blades borne on tall stalks, palmate, 2–6 in. wide, with 5 nearly equal triangular divisions, those of the sterile lvs. less acute; surfaces pubescent. Reproduces by numerous buds as well as by spores. W. Indies, Mex., S. Amer.

élegans, Davenp. Lvs. 4–10 in. wide, with a broad sinus at the base and 5 long slender, lanceolate divisions: plant smooth. Mex. G.F. 4:485.

L. M. UNDERWOOD.
R. C. BENEDICT.†

HEMIPHRÁGMA (*half partition,* referring to structure of the capsule). *Scrophulariàceæ.* One trailing perennial herb, *H. heterophýllum,* Wall., sometimes grown abroad for rockwork and ground-cover, requiring protection in England. It is prostrate, with wiry branches, pilose or becoming glabrous: lvs. on main st. opposite, petiolate, orbicular and crenate; on branches small and fascicled, linear and ciliate: fls. sessile in the axils, small, pink; calyx 5-parted, with linear segms.; corolla-tube short, the limb 5-lobed and nearly equal; stamens 4: fr. a fleshy caps. or berry, shining, red. Himalaya region.

L. H. B.

1807. Hemionitis palmata. (×½)

HEMIPTÈLIA: *Zelkova.*

HEMITÈLIA (Greek, *with half a roof;* referring to sori). *Cyatheàceæ.* Tree ferns of the tropics, with round or semiglobose sori and an inferior indusium, consisting of a scale which is often indistinct and deciduous. Some 20 species occur in both hemispheres. This genus is not very well distinguished from Cyathea and Alsophila, differing only in technical characters of the indusium. For cult., see *Cyathea* and *Alsophila;* also article on *Tree ferns,* under *Ferns.*

guianénsis, Hook. Rachis slightly scaly and hispid: lvs.

bi-tripinnate, the secondary rachis distinctly winged, especially at the upper portion: sori few in each segm., usually 2–4; indusium ciliate and often lobed. Var. **Paràdæ**, Hort., is the form commonly in cult. British Guiana. I.H. 24:280.

Líndenii, Hook. Lvs. pinnate, the pinnæ distant and slightly stalked, 6–12 in. long, 1–1¼ in. broad, the base truncate or wedge-shaped: sori in 2–3 irregular lines near the margin. Venezuela. I.H. 42:46.

L. M. UNDERWOOD.
R. C. BENEDICT.†

HEMLOCK in Old World literature is what is known as poison hemlock, an umbelliferous herb, *Conium maculatum*. By hemlock, Americans mean hemlock spruce, an evergreen tree, *Tsuga canadensis*.

HEMP: common hemp is *Cannabis sativa* (which see); **Bowstring H.**, *Sansevieria;* **Manilla H.**, *Musa textilis*; **Sisal H.**, *Agave rigida* var. *Sisalana*.

HEN-AND-CHICKENS. A proliferous form of the English daisy, *Bellis perennis;* also the thick-leaved rosettes of Cotyledon, used in carpet-bedding, usually as Echeveria.

HENBANE: *Hyoscyamus niger*.

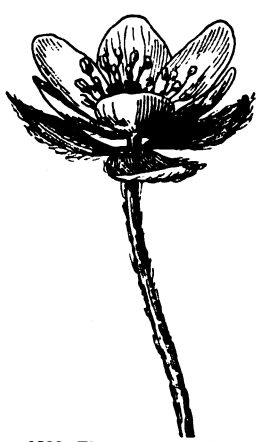
HENFRÈYA: *Asystasia*.

HEPÁTICA (*liver-like*, from the shape of the leaves). *Ranunculàceæ*. HEPATICA. LIVER-LEAF. MAYFLOWER (incorrectly). Stemless low perennials sometimes grown in the wild border for very early spring bloom.

Leaves 3-lobed and sometimes toothed, appearing after the fls. and remaining green over winter: scapes 1-fld., with an involucre of 3 small sessile lvs. simulating a calyx; sepals petal-like, white, pink or purple: achenes short-beaked, pubescent. (Fig. 1808.)—A genus of 3 species, natives of the north temperate zone, grown in open flower-beds for their attractive fls., which appear in early spring; the peculiar foliage is also much admired.

The plants prefer shade, but do fairly well in open places. They should remain undisturbed from year to year, in rich well-drained loam. Well suited to the north or east slope of a rockery. Plants kept in pots in a coldframe until midwinter will quickly bloom at any time desired if removed to a warm room or greenhouse.

Propagation of old plants is easily accomplished by division of the roots. Seeds may be sown very shallow in a moist, shaded soil. The seed is sometimes started in frames in very early spring and the plants transplanted to the garden later, but little is gained by this as the flowers will not show until the next season.



1808. Flower of Hepatica. (Natural size)

trîloba, Choix (*Hepática Hepática*, Karsten. *Anemòne Hepática*, Linn. *A. trîloba*, Hort.). Scapes 4–6 in.: lobes of lvs. obtuse: fls. ½–1 in. across; sepals oval or oblong, obtuse. Earliest spring. E. U. S., Eu., and Asia. B.M. 10. B.R. 387 (as *H. americana*). White-, blue-, and pink-fld. forms have been fixed in cult., and are known as var. **álba**, Hort.; var. **cærùlea** fl.-pl., Hort.; var. **rùbra** fl.-pl., Hort. Gn. 26:24. Gn. M. 15:306. G.C. 1873, p. 645 (var. *marmorata*, Moore).

acutíloba, DC. (*H. trîloba* var. *acùta*, Pursh. *Anemòne acutíloba*, Laws, *H. acùta*, Brit.). Fig. 1809. Much like *H. triloba*, but with the lobes of the lvs. ovate and acute, occasionally the lateral lobes 2-cleft (rarely the middle one): achenes slightly stipitate. E. U. S.

angulòsa, DC. (*Anemòne angulòsa*, Lam.). Plant tufted as in the other hepaticas, hairy: lvs. 3–5-lobed, lobes often serrate: involucre near the fl. toothed; fls. large, blue, whitish or reddish. Hungary. B.M. 5518. G.C. 1865:698. Gn. M. 4:190. Gn. 26, p. 25. G. 2:551. Var. **álba**, Hort. Fls. large, pure white. var. **ròsea**, Hort. A rose-colored form. Var. **lilácina**, Hort. A free-flowering variety with lilac-colored fls.

1809. Hepatica acutiloba. The flowers of hepatica droop and close at night.

K. C. DAVIS.

HEPTAPLEÙRUM: *Schefflera*.

HERACLÈUM (dedicated to Hercules, who used it in medicine, according to Pliny). *Umbellíferæ*. COW-PARSNIP. Perennial or biennial herbs, some of which are used in bold planting effects where there is ample space.

Mostly tall and coarse herbs, with prominent and often very large lobed or pinnate or dissected lvs.: fls. in large umbels, white or purplish, with mostly obcordate petals and the outer ones often larger and cleft and forming rays: fr. obovate, oval or orbicular, dorsally flattened, the oil-tubes extending scarcely below the middle.—Probably 70 species, in the northern hemisphere, one reaching Abyssinia.

Heracleums are not suited for general gardening, but are sometimes grown in wild gardens or parks, or as single specimens on lawns, where a very bold and striking object is desired. The garden species are coarse herbs, growing 5 to 10 feet high, with broad foliage, which is their chief beauty. They are adapted to

all soils, but prefer a rich moist soil, and often do well at the edge of running water. They should not be allowed to go to seed. If these plants are grown on an open, sunny lawn, they should be liberally supplied with moisture at all times. Propagated by division or seed.

A. *Plant biennial (or biennial-perennial).*

sibíricum, Linn. Lvs. scabrous to hirsute, pinnate or deeply pinnatifid; lfts. oblong or ovate; segms. lobed or palmately parted, serrate: fls. yellowish, without rays; petals about equal: fr. subrotund-oval, deeply notched at the apex. Eu., N. Asia.—Height 5–6 ft., blooming in summer, forming a handsome plant with the much-cut foliage.

platytænium, Boiss. (*H. éminens,* Lange). Lvs. often 2 ft. across, tomentose beneath, the lower ones trisect and the upper ones less deeply cut, segms. stalked and obtusely palmate-lobed: fls. white, in hairy umbels sometimes 1 ft. across: fr. large, hairy. W. Asia.—Said to be specially valuable for woods and wild-gardens: 4–5 ft. Sometimes perennial.

pérsicum, Desf. Lvs. large, once- or twice-pinnate, glabrous above and pubescent beneath, the segms. in 3 or 4 pairs, much cut into narrow divisions: fls. white, in large somewhat pubescent umbels. W. Asia.—Reaches 12 ft. in height. Sometimes perennial.

pubéscens, Bieb. (*H. caucásicum,* Stev.). Lvs. pinnatisect, pubescent beneath and glabrous above, the segms. 2 or 3 pairs, with elliptic lobes: fls. white, the setulose umbels many-rayed: fr. elliptic, pilose, only the margin aculeate. Asia Minor. Sometimes perennial. Var. **Wilhelmsii,** Boiss. (*H. Wilhelmsii,* Fisch. & Mey.) differs in its prominently aculeate fr.

Lehmanniánum, Bunge. St. stout: lvs. glabrous above and pubescent beneath, the lower ones pinnatisect; segms. 2–3 pairs and pinnatifid and at apex 3-parted, the lobes short-ovate and acute and coarsely toothed: fls. many, dull pink, in large umbels. Turkestan; 3–7 ft. Gn. 66, p. 259.

1810. The Goose Tree of the herbalists.

AA. *Plant perennial.*

lanátum, Michx. Lvs. trisect, tomentose beneath; segms. petiolulate, rotund, cordate, lobed and sharply serrate; lfts. of the involucel lanceolate: fr. oval-orbicular. N. Amer., W. Asia. Mn. 4, p. 164.—A striking coarse pubescent plant of low or moist grounds, 4–8 ft. high.

villósum, Fisch. (*H. gigantèum,* Hort.). Lvs. sinuate-pinnatifid, sharply serrate, acuminate, woolly-tomentose beneath; lfts. of involucres short, bristly, deflexed: fls. white or whitish, in umbels sparingly rayed: fr. elliptic, ciliate, woolly on the back. Caucasus. G.C. III. 3:437; 20:271. J.H. III. 49:115. G. 7:537. G.W. 7, p. 357. Gn.W. 20:47. Gn.M. 14:171.—A bold species, reaching 8–12 ft. in height. Said to be sometimes biennial.

Mantegazziánum, Sommier & Levier. A recent intro. into cultivation and said to be the finest of the genus: lvs. 3 ft. long, deeply cut into many oblong-lanceolate notched lobes, making a gigantic clump: fls. clear white, large, in umbels 4 ft. across, produced in great number. Gn. 59, p. 148; 74, p. 526. G.W. 12, p. 410; 15, p. 636.—This noble species comes from the Caucasus. Seeds were sown at Geneva, Switzerland, in 1893, germinated in 1894, and the plants were 8 ft. high, in 1896. It grows 9 ft. high, and perhaps more. Said to be of easy cult., preferring deep rich soil that is cool and damp; the roots, and especially the tap-root, should remain uninjured, and it is said that it thrives better if not transplanted, although the seedlings may be handled in pots. L. H. B.†

HERBA IMPIA of the old herbalists is *Gifola germanica.*

HERBALS. Books on plants, published from the fourteenth to the middle of the eighteenth century, were largely written from the medicinal point of view, and were often called herbals. The scientific point of view of plant-knowledge is conveniently dated from 1753, when Linnæus published his "Species Plantarum." Of the herbalists, John Gerarde is probably read most at the present time. His style is chatty, quaint and personal. One of the notions accepted by the early herbalists was that of the vegetable lamb, which is pictured in this work under *Cibotium* (Fig. 961). Another idea that fascinated these worthy plant-lovers was that of the barnacle goose tree. Fig. 1810 is reproduced from a book by Duret, 1605, and shows how the fruits that fall upon dry land become "flying birds," while those that fall into the water become "swimming fishes." Other conceptions of this goose tree are reproduced in the "Gardeners' Magazine," 35:749 (1892). Almost every large library possesses a few herbals, as Matthiolus, Bauhin, L'Obel and Fuchsius. The largest collection of herbals in America is the one given by the late E. Lewis Sturtevant to the Missouri Botanical Garden at St. Louis. See Agnes Arber (Mrs. E. A. Newell Arber), "Herbals: Their Origin and Evolution," a recent British work. The herbals are invaluable in tracing the growth of ideas about plants.

HERBARIUM. An herbarium is a collection of dried plants systematically named, and arranged in cases for ready reference and protection. In the study of systematic botany such collections have existed for many years, and they are an absolute necessity to the student, supplementing field work. Indeed, without an herbarium, scientific systematic work would be practically impossible, for the identification of species, the study of the plants of any given area and the comparison of the flora of different regions can be conducted thoroughly only where specimens of the plants under consideration are at hand and can be readily consulted. Type specimens of new species are deposited in herbaria, and reference is constantly being made to these types to settle the identity of species when meager descriptions only are available. Floras of distant regions have been written by those who have never visited the places, but have worked on the collections that

have been brought back. It is only through such collections of dried plants that publications of the plants of a region are possible. It is a vital supplement to actual work in the field. Large and important herbaria exist at many centers of botanical activity in this country and abroad, while private collections are countless.

There are few collections of pressed specimens of plants embracing the wide range of horticulture, and there should be more of them. The advantage of such herbaria in identifying plants under cultivation and in comparing the many forms that are constantly being evolved, and that do not occupy a place in collections of native plants, must be obvious to everybody. Every horticulturist should have a good herbarium, for it increases very largely the value of his work besides giving much pleasure in the preparation and use of it.

1811. A common method of mounting herbarium specimens.

It is like a reference library and it enables a nurseryman to keep his stock true to name. One of the most difficult problems for a systematic botanist or a horticulturist to meet is that of nomenclature, and much trouble and waste time can be avoided by having at hand an authentically named collection, embracing as many forms as possible. A good working herbarium can be made by pressing the cultivated plants at hand and by securing from others specimens of additional forms.

In collecting plants for the press it must be remembered that they are to be mounted on paper 11½ by 16⅜ inches in size. These are standard dimensions. Take up small plants by the roots, and of larger plants secure a branch that will show typical leaves and flower or fruit according to what is desired. Note with each plant, on a label or on a tag slipped on the end of the stem, the important characters that are to be entered on the final label, such as trade name, color of flowers, whether it is annual, biennial or perennial, date, locality, collector, and so on. These should be kept carefully with the plant.

The specimens are then laid for pressing between sheets of unsized paper that will readily absorb the moisture. Newspaper will do, but prepared sheets can be bought at very small cost of any botanical dealer, from whom also can be obtained collecting-boxes, trowels, presses and all other details used in making an herbarium. Plants can be folded once or even twice to be adapted to the size of the sheet, unless too many leaves overlap, in which case two specimens, or even more, can be made of the same plant and pressed separately. A little skill will enable one to lay out his plants artistically, showing upper and under surfaces of the leaves, and the various sides of the flowers. Sometimes it is best to section a thick stem or root. The folder with its inclosed plant or plants and accompanying data is then put between driers, which are sheets of a heavy felt paper, very absorbent. On this is placed another folder, and so on until a pile a foot or more high is reached. This pile is then placed in a press. The best kind of press is a simple, portable one, composed of two frames, each made of strips of hard wood arranged at right angles to each other. The press is then tightened by strong straps. The driers should be changed daily for a few times, and the specimens examined, and then less frequently till they are perfectly dry. Most excellent results in quick drying can be secured by means of sheets of corrugated card board with one side flat. (See J. F. Collins, Rhodora xii. 221, 1910). By placing a sheet between the various driers each plant is isolated from its neighbors, and the circulation of air through the pores speedily dries the plants. Put the press in the sun when possible. The old-fashioned method of using plain boards and a heavy weight on top is not to be recommended.

The specimens should then be mounted on sheets of stiff, white, calendered paper, 11½ by 16⅜ inches, eighteen pounds to the ream being standard weight. This is for a perfectly appointed herbarium. The plants can be kept in the original folders and filed in that way, but, for safety and ease in handling, the specimens should be properly secured to the sheets. The regular method is by gluing them down, fish glue being used, and supplementing this with strips of gummed paper, surgeon's isinglass plaster being the best material. These strips are put over portions of the plant that are liable to separate from the sheet. In some large herbaria gummed strips are used entirely. Each mounted sheet must contain but one species, variety or form, but two or more different collections may be on a single sheet. A label accompanies each collection composed of one or more specimens. A convenient size is 3½ by 1¾ inches. On it should be written the name, locality, date, collector and any useful data such as have been mentioned above.

The mounted sheets are put loose into genus covers of stiff manila paper, 16½ by 11⅞ inches, each cover devoted to a single genus. The name of the genus is written in the lower left-hand corner, and that of the species in the lower right-hand corner. More than one species of the same genus can be put into the same cover. These covers are placed systematically in the herbarium case fitted with pigeon-holes wide and deep enough to hold the covers easily and 6 inches between shelves. The doors must close tightly to keep out insects and dust. The cases are of varying heights, according to convenience, and are generally of wood. The most approved have two rows of about thirteen pigeon-holes each, and are made of steel, thus securing absolute safety.

An herbarium was called "Hortus siccus," or dry garden, by the ancients, but, although in one sense true, it does not convey the correct idea. To the true

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scientific lover of plants, whether botanist, horticulturist, florist, or nurseryman, a carefully equipped collection of dried plants is not only a great and necessary aid, but a true delight. In them he sees the living plants that they represent, and to dissect a flower, however old it may be, he has but to boil it for a few seconds in a retort, and it can be as easily dissected as if fresh.

WALTER DEANE.

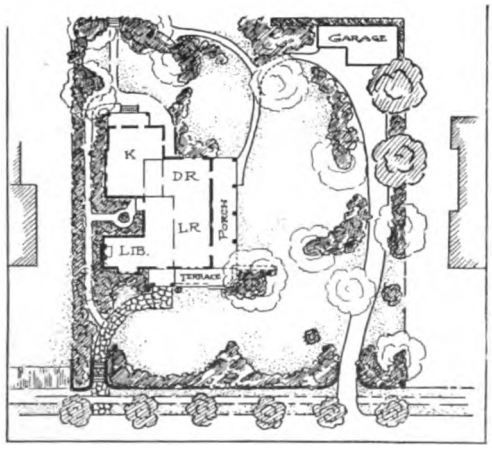
HERB, HERBS. An herb is a plant that dies to the ground each year, or at least that does not become woody. It may be annual, as bean, pigweed; biennial, as mullein, parsnip; perennial, as dictamnus, rhubarb; many of the perennials live only three or four years effectively. To the gardener, however, the word "herb" is ordinarily synonymous with herbaceous perennial; and he usually has in mind those particular perennial herbs grown for ornament, and which remain where they are planted. Goldenrod, bleeding-heart, sweet william, hollyhock, daffodil are examples. To many persons, however, the word herb is synonymous with sweet herb, and it suggests sage and tansy.

Herbs are grown in an herbary, which, as here understood, is a garden or collection of herbs, and particularly of perennial herbs, since the collection may then be more readily and certainly continued.

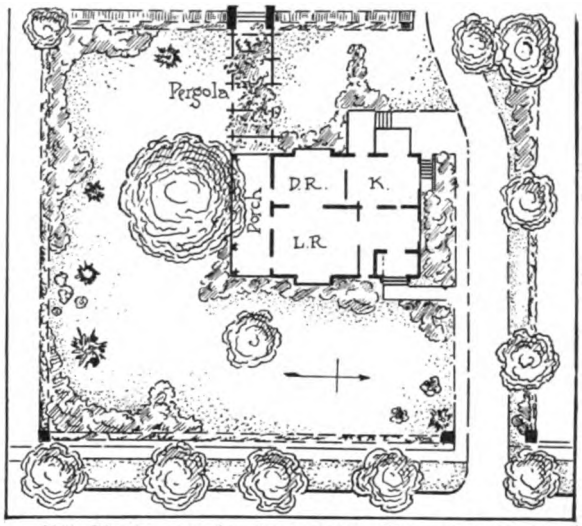
Herbs have two kinds of values,—their intrinsic merits as individual plants, and their value in the composition or the mass. It is usually possible to secure both these values at one and the same time. In fact, the individual beauty of herbs is enhanced rather than diminished by exercising proper care in placing them. Planted with other things, they have a background, and the beauties are brought out the stronger by contrast and comparison. It is quite as important, therefore, to consider the place for planting as to choose the particular kinds of plants. The appreciation of artistic effects in plants is a mark of highly developed sensibilities. Happily, this appreciation is rapidly growing; and this fact contributes to the increasing popularity of landscape gardening and ornamental gardening. Some of the best effects in herb-planting are to be seen in the wild, particularly along fences, roads and streams. The planter must remember that herbs are likely to grow larger and more bushy in cultivation than in the wild.

A strip or border along the side of a lawn, or bounding an area, is the best place for a collection of herbs—whether annual or perennial—that are grown for ornamental effect. (See Fig. 597, Vol. I.) About any place there will be special uses of herbs. (See the plans, Figs. 1812, 1813.) The home-maker should cover the bare and unseemly places about the borders of his place (Fig. 1814). He may utilize a rock or a wall as a background (Fig. 1815). He may hide the ground-line about a post (Fig. 1816) or along a fence. Some of the commonest herbs, that excite the least admiration, are handsome when well grown and well placed. (See Fig. 1817.) One should always plant where the herbs will have relation to something else,—to the general design or handling of the place. This will usually be about the boundaries. The hardy border is the unit in most planting of herbs. (See Figs. 1814, 1818.) A rockwork herb border (Fig. 1819) is often useful in the rear or at one side of the premises. It is well to fill some of the corners by the house (Fig. 1820). In remote parts of the grounds, half-wild effects may be allowed, as in Fig. 1821. A pond or pool, even if stagnant, often may be utilized to advantage (Fig. 1822). A good herb out of place may be worse than a poor herb in place. But when herbs are grown for their individual effects, give plenty of room and good care (Figs. 1823, 1824). Other discussions of herbs in relation to planting will be found under *Annuals*, *Biennials*, *Border*, *Landscape Gardening;* also, for special uses, *Alpine Plants*, *Autumn-Gardening*, *Kitchen-Garden and Flower-Garden*, *Spring-Gardening*, *Wild-Gardening*, and others.

L. H. B.



1812. Plan of a residence area on uneven ground. The heavy planting against banks and borders provides areas for herbs as well as for shrubs. The location is indicated of library, dining-room and kitchen.



1813. Planting areas in a home ground. The general center is kept open. There are trees along the streets and two on the lawn. About the residence and on the boundaries, as well as in the parking at one side, there is opportunity for herbs and shrubs. D.R., dining-room; L.R., living-room; K., kitchen.

Herbaceous perennials in landscape planting.

No clear definition can be drawn between herbaceous perennials, biennials and annuals, between herbs and woody plants, for there are tender herbs that in a warmer climate would become shrubs or even trees, biennials that become perennials from stolons or offsets, and annuals that become biennials from seed germinating late in the season. Strictly speaking, however, herbaceous perennials are plants having perennial roots with tops that die to the ground annually, such as the columbines, larkspurs, day lilies, peonies, and most sedges, grasses and ferns. It is customary, however, in publications relating to this class of plants as well as in actual use, to include closely allied species with evergreen foliage, such as statice, yucca, sempervivums and certain pentstemons, together with plants having more or less woody and persistent above-ground stems, such as the suffruticose artemisias and the evergreen creeping species of phlox, veronica, vinca, the iberis, the

helianthemums, and many alpine plants, while most bulbous-rooted plants which are true herbaceous perennials are separately classified and grown as bulbs.

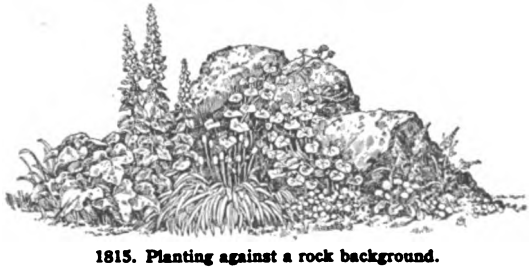
Herbaceous perennials are an exceedingly important element of landscape, for they predominate in the mat of grassy or sedgy plants, covering dry or wet open

1814. An informal herb border.

fields, and in the surface vegetation under woods and shrubby thickets, either as a grass crop, composed of a comparatively few species cultivated for economic purposes, or as a wild growth made up of many species. The most attractive of these native plants are being cultivated and improved more and more from year to year for ornamental purposes, and are planted in the flower-garden, in artificial plantations of shrubbery and in the wild-garden. It is to such natives and to exotics of the same class, which are cultivated for a similar purpose, that reference is to be made hereafter.

Fifty years ago nearly every well-to-do family maintained a flower-garden, in which there were from fifty to one hundred and fifty species and varieties of herbaceous perennials, and there were few of the humbler families that did not have a dozen or more species established about their homes. Such plants were distributed by exchange among neighbors and were propagated and offered at retail by dealers, who, however, gradually allowed their stock of plants to run low or abandoned them altogether, until many kinds dropped out of cultivation or were neglected in favor of the tender "bedding out" plants that were brought suddenly into favor by the displays at the Philadelphia Centennial Exposition. Then they gradually declined in favor until the interest was newly revived at the period of the Chicago Exposition.

Since that time there has been such a constantly increasing interest in herbaceous perennials that there are now offered in catalogues of American nurserymen and collectors of native plants, nearly 3,000 species and



1815. Planting against a rock background.

varieties, exclusive of the many garden forms that are distinguished chiefly by the color of their flowers.

In use, the species and varieties of herbaceous perennials may be broadly separated into three groups.

First, plants for the garden requiring the favorable conditions of a highly cultivated ground, and careful attention to attain perfection and to persist and increase from year to year. This would include many exotics, some native species and most of the horticultural varieties. Many of such species which would find a congenial place only in the garden have attractive flowers which are so fugitive that they can be enjoyed only on the plant. Other species which are suitable to cut flowers from can hardly be grown in the flower-garden in sufficient quantity liberally to meet the floral requirements of the home, and they should be grown in quantity in the kitchen-garden or in a special cut-flower garden, for their crops of flowers. Included among plants of difficult cultivation with fugitive flowers are the rock or alpine plants, many of which are offered in European catalogues. (See article on *Rock Gardens*.)

Second, plants for the shrubbery, having aggressive habits, which make them rather objectionable in the flower-garden, but fit them to withstand successfully the crowding of shrubs. This class of plants will give variety and prolong the flowering season of shrub borders about lawns, and would be made up chiefly of strong-growing natives and a few of the more persistent exotics.

Third, plants for the wild garden, including the species that require for success some one of the many special conditions prevailing in uncultivated or uncultivable land, or which are so rampant as to require the restraint that some one of these natural conditions will provide. This class of plants would be made up chiefly of natives and a few of the more persistent exotics, and they would be used to enrich groups of native plants under woods, in meadows, along streams, ponds and hedge-rows and on poor soil. There are attractive plants that will and do grow successfully under all these conditions without special cultivation, and many of them may be already on the ground. If every plant in a group of natives is watched for at least a year, it will be found that many are so attractive at one season or another that they will be retained and developed in beauty by the gradual removal of the less desirable kinds, for which others that are more desirable may be substituted.

1816. The ground line is hidden by herbs or shrubs.

In arranging plants in new plantations, or in modifying existing plantations in gardens, lawns or woods, much more effective landscape compositions and more agreeable color effects can be secured by using large quantities of a few sorts than by using a few individuals of many kinds. Groups of different species should be chosen that will give from period to period during the flowering season effective and dominating masses of foliage and color, and all other plants of the garden which appear at the same time should be made subordinate to these.

Herbaceous perennials are propagated by divisions and from offsets, cuttings and seed. Some kinds, as

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dictamnus and papaver, may be propagated by root cuttings. The exotic species of gardens and many of the more readily grown natives can be obtained in wholesale quantities from nurserymen. A few exotics and a very large number of attractive native species can be procured in wholesale quantities from collectors of native plants, many of whom also offer nursery-grown plants of the best natives and of a few exotics. The attractive native plants in any region can be transplanted with little difficulty if they are collected with a good sod of earth about the roots. WARREN H. MANNING.

The culture of herbaceous perennials.

A good number of the herbaceous perennials grown in gardens are exceedingly easy of cultivation, thriving well in any moderately rich soil of suitable physical condition, and enduring winter cold and changeableness and summer heat and drought. There are, however, other species that do not grow well in the American climate, except in more moderate seasons or when placed where the climate is locally modified. Whether the plants one desires to grow be easy or difficult of culture, one should aim first of all for a luxuriant growth, for any time or labor saved by poorly preparing the soil, or any money saved by the use of weak or stunted plants will be regretted later. Unless it is intended to imitate the effect of certain barrens in nature, a garden without luxuriance is lacking in essential quality.

The preparation of ground for planting consists, in the order of importance: in making the soil by openness and fineness suitable for root-penetration to a depth of 18 inches to 2 feet; in providing underground drainage at a depth of at least 2½ feet; in making the soil sufficently fertile; and in making the surface soil not liable to "baking."

Depth and physical condition of soil are very important, and should be one's first care. If the season is short and work must be rushed, it is better to omit the manuring and to devote all one's energy to securing a deep feeding-area for the roots and a fine physical condition of the soil. In the hardy border the roots are able to penetrate far more deeply into the soil than they do usually in a wild state or in ordinary field culture. This vigor of root-growth reaching to good depth, as compared with that of equal vigor but nearer the surface, gives not only greater endurance of drought but aids the plant to endure changeableness of weather, and particularly contributes to hardiness. Many plants are hardy only if protected until the roots are thoroughly established. This is more often noticed with trees and strong-rooted plants that are able to penetrate deeply into the subsoil, but the same applies to herbaceous plants, except that it is usually necessary to loosen the subsoil to ensure penetration by their finer roots to a satisfactory extent. It is not necessary to make the subsoil equal in richness to the upper part, but it should preferably be mixed with a portion of the surface soil.

1817. A good effect with a species of Rheum.

1818. A mixed herbaceous border.

The fine roots are the feeding roots and the surfaces of the soil-particles are their feeding-ground, so that in making the soil-particles smaller the feeding-surface is vastly increased, thus allowing for more roots and closer planting. A fine physical condition can usually be obtained by turning the soil over a few times. No soil should be turned or handled when too moist to crumble, as the clay in the soil is quick to become puddled, and therefore impervious to feeding-roots.

Underground drainage is necessary, since most plants cannot grow in soil filled with stagnant water. When the natural subsoil drainage is not sufficient, artificial means should be used. Unless the drainage is good, many plants will be injured in the rainier seasons or killed in winter. Plants that are not firmly established are often easily killed by excess of moisture about the roots during their dormant season; for example, many bog-plants otherwise perfectly hardy will winterkill if planted late in the fall. A further fact showing the effect of water on dormant roots is that many plants if cut down low enough in the fall to allow water, as from melting snow, to reach the root through the hollow stems, will often be entirely rotted by spring. Thus, when it is necessary to destroy goldenrod, the dry stems may be mown in late autumn with a sharp scythe. The vulnerability of the root to water coming through the stem may be easily seen by comparing in the spring roots of corn, the stalks of which were cut at different heights the previous fall.

In the hardy border, no large amount of coarse or highly fermentable material should be used. The enrichment of the land should, if possible, be made while preparing the border, and any fertilizers used should be well mixed with the soil. Even if a liberal quantity of stable manure is available, it is well to use some potash or phosphoric acid in connection with it. A light top-dressing of manure given in the fall will keep up the fertility, correct the soil in various ways, and afford a slight winter protection, which is appreciated by even the hardiest plants. Over-richness as well as poverty of soil tend to make plants in general less hardy, but usually a great abundance of plant-food should be given, especially for the hardier species with vigorous constitutions and long season of growth. Many plants having a season of rest in late summer do best in land not overly rich, especially if the position is moist.

A loose and open surface soil prevents baking after

rains and waterings; saves some of the labor necessary to keep the soil open and friable; allows the growth of many smaller, finer-rooted or creeping plants that cannot grow well in a stiff soil; permits the sowing of many annuals in the border. Many low-growing plants are injured on clayey soil by having the under surfaces of the leaves coated with earth by spattering of rain. A clay soil may be made more loose by the addition of manures, sawdust, coal-ashes, sand or almost any such material. A light, fine mulch should be kept on the surface of a clay soil.

The points to be borne in mind in planting should be healthy plants, careful planting and sufficient thickness of planting. Plants should be obtained which have not been stunted, as a weakened plant will seldom make as good a specimen as if rightly treated from the start. When plants are received from the nursery they may be heeled-in if necessary, but every day plants are left where they have no root-hold on the soil is an injury to them, in proportion to the suitableness of the weather for root-growth. If plants must remain any considerable length of time before being placed in their permanent position it is best to plant them in reserve ground, and to remove them when desired with balls of earth.

Symmetry of top-growth is to some extent, at least, dependent on symmetry of root-growth, so that by careful planting the roots not only become more quickly and strongly active, but give us hope for a more symmetrical plant than can be secured by careless planting. The proper way to place a plant in the ground is to distribute the roots equally about the plant, leaving the tips pointed downward, and then to firm the soil sufficiently about the roots.

A perennial border should be planted rather thick, so that when in foliage it shall appear as one mass. Any showing of soil between plants is not only unnatural but destroys the beauty of the border as a whole. Of course, if plants are wanted for their individual or separate merits, they should be given full room.

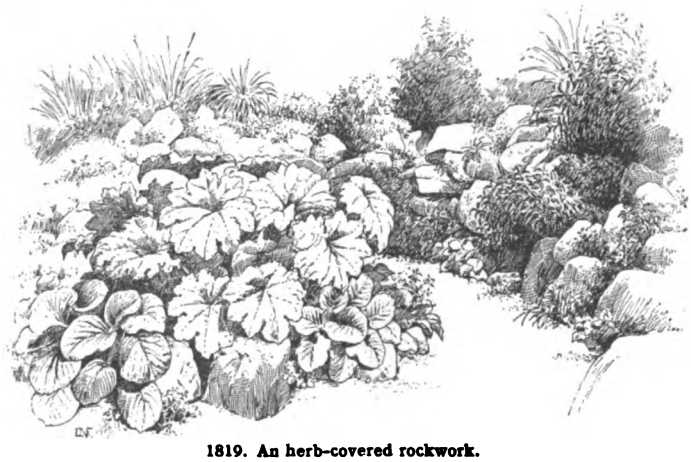
Winter protection of herbaceous perennials.

The protection of species not reliably hardy may be accomplished with any material suitable for keeping out frost which is not naturally too moist or close. The material should preferably be heaped over the crown of the plant to shed part of the rain as well as to prevent quick changes of temperature, or wholly to exclude frost, as the plant may need.

The material to be used will be determined for the plants to be protected, by what is on hand or easily obtainable, and by the presence or not of mice or other vermin, which often work under such material as straw. Protected plants should be examined frequently in the winter, and if mice are present they may be killed or driven away by placing a few drops of carbon bisulfide in each hole found. (This is also a good way to rid coldframes of these pests. Plenty of ventilation should be given at the time, as the gas evaporated is destructive to vegetation. As the gas is heavier than air it sinks for the most part down the holes.) If, however, mice are not troublesome, there is no better material for keeping out cold and shedding water than straw. Nature's plant-protection is to use the foliage and stems of the plant themselves, the whole ground surface being covered as the weather grows colder with successive coatings of snow, which protection again grows lighter as spring approaches. This is still the ideal winter protection for plants, but snows are likely to disappear in midwinter and mice are well adapted to live under heavy litter. Where mice are troublesome, a light material may be made by composting leaves, manure rakings from lawns, greenhouse waste, weeds not in fruit as pulled during the season, and the like. The material should be earthy enough to keep mice out, and loose enough to permit of easy removal in spring. It should also be loose enough not to hold too much water in winter. Sawdust and charcoal are examples of such material.

1820. A rear corner, embellished with weeds.

Most of the plants that are largely cultivated need no protection, but all herbaceous perennials, unless they are evergreen or easily smothered, are benefited by a slight covering to protect the soil from alternate freezing and thawing. If the plants are evergreen, a covering to supply shade is often desirable. Other plants, such as *Helianthus decapetalus fl. pl.*, really need protection, not to exclude frost but to lessen considerably the severity of the winter. Still others, as many of the lilies, are best covered to the exclusion of frost. In general, the plants that need complete protection have crowns below the surface, and so may be covered with any amount or kind of material. When it is desired thoroughly to protect crowns on the soil surface, flats may be first placed over the crowns before adding the protection. In most cases, late fall plantings should be protected to some extent, since plants are less hardy when poorly established in the soil. See *Winter Protection*, Vol. VI.



1819. An herb-covered rockwork.

Propagation of herbaceous perennials.

The methods of propagation most used are by seed, by division of the plant, and by cuttings.

Propagation by seed is commonly not of use for the perpetuation of horticultural varieties, although to a varied extent with different species any variety tends to reproduce its characteristics more perfectly the longer it becomes established as a variety. However, some of the garden plants have been separated into their present number of varieties or forms mainly by continual propagation by seed- and plant-selection, and such may be satisfactorily increased by seed. An example might be taken in the hollyhock, although, if a group be left to resow itself, or no seed-selection be maintained, it will soon become mainly composed of single-flowered plants

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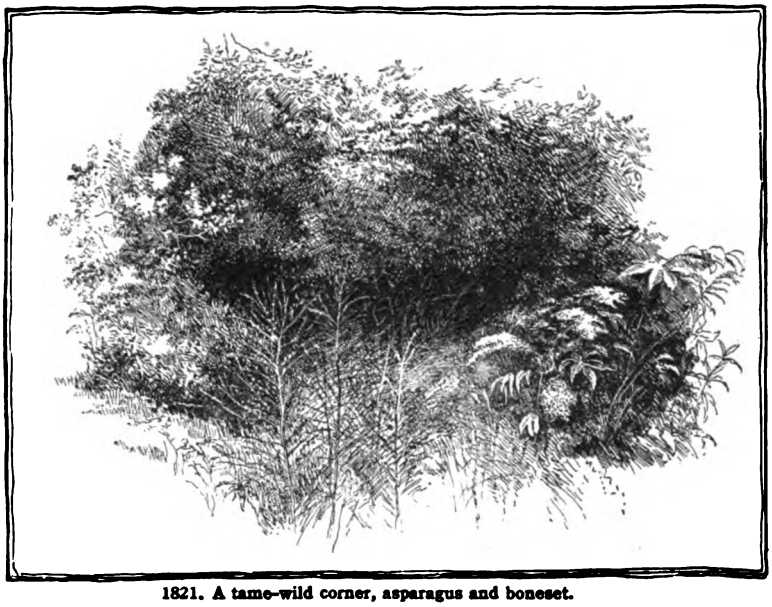

1821. A tame-wild corner, asparagus and boneset.

by reason of their greater seed-production. In general, propagation by seeds is satisfactory for all established species and for such varieties and forms as have been thoroughly established by selection.

Seed-sowing is not, however, always an easy way to increase many of our garden plants, as there are often a few small items necessary to know concerning a species before success can be assured. Seeds of some perennials remain dormant for a long period after sowing, and, in general, they are very much slower in starting than annuals. Some require more heat than others to germinate, while others require a very cool soil. Many plants brought into cultivation from foreign countries or milder parts of our own land do not produce seed that will remain sound over winter in the earth, nor do seedlings of all hardy perennials withstand the colder season: for example, *Papaver orientale*, a hardy plant itself, produces a great quantity of seed which germinates readily as it falls, but the seedlings will not survive the winter in the northern United States unprotected.

A general rule for seed-sowing would read: Sow the seed when ripe, and then maintain such conditions of temperature and moisture as the seed would receive in the native habitat of the plant. Native American plants not from decidedly milder parts, and many foreign species, may be easily increased by sowing of seed when ripe in the open ground. Among such might be included rudbeckia, aquilegia, coreopsis, monarda, asters (perennial), delphiniums, digitalis, *Dianthus barbatus*, and phlox, all of which will bloom the following season.

Plants usually have one or rarely two particular seasons for blooming, and unless of sufficient size and suitable condition when that season approaches, they will wait for its recurrence before showing flowers, so that by sowing seed early in the spring and giving good cultural attention to the plants, we may expect to flower the first year many plants naturally blooming late in the year, or such as are somewhat floriferous at nearly all seasons: for example, *Lobelia cardinalis* and other lobelias, many of the native asters, *Gaillardia aristata* var. *grandiflora*, *Bellis perennis*, hollyhocks, platycodon, delphiniums, hardy chrysanthemums, salvias, rudbeckia, dahlias. See *Seeds*, Vol. VI.

Propagation by division is simply the separation of a larger clump of roots and crowns into smaller plants. In the case of plants producing buds on the roots, this division may be carried further, and small pieces of the root used to grow other plants.

The separation of plants as practised in the garden is not usually so much for the purpose of increase as to avoid overcrowding of roots and crowns, with loss of vigor to the plant; for example, a plant of iris, having been undisturbed for a number of years, becomes a tangled circular mat of rootstocks, which in the center cannot find room to grow, and so the plant appears as a large mass of rootstocks, throwing up foliage only on the outer ring. The period in which a plant may remain in any one place without needing separation will vary with the vigor of growth of the plant in each position; a group of plantain lily in a favorable situation will need separation every two years, while in a poorer place it might remain four. However, the average length of time for a few typical species may be given thus: *Bellis perennis*, pompon chrysanthemums, and other strong-spreading, shallow-rooted and easily established plants do best with yearly separation; *Phlox maculata* and monarda every two years; helianthus, asters and many of the compositæ and *Phlox decussata* about every three years; *Convallaria majalis* and many spring-flowering bulbs every four years; such plants as peonies may be left for a longer period.

In general, better flowers are secured from a plant with but one crown than when two or more are left, but unless the new growths are crowding out the central parts or are themselves too numerous to make a vigorous growth possible, division is not necessary. In fact, many plants require a better establishment in the soil than can be given by transplanting or than they can

1822. Pool made attractive by planting of herbs.

quickly secure, and such are best undisturbed until quite overcrowded. The question is whether by dividing a plant better flowers and foliage may be obtained than by allowing it to become more thoroughly established.

The time of year for separation will vary as to the blooming season of the plant; that is, for early-blooming plants late summer or early fall, and for late-blooming plants either late fall or spring, preferably the latter, as many otherwise hardy plants are either weakened or killed if disturbed in fall. See *Separation*, Vol. VI.

1823. A good subject—Eupatorium.

Propagation by cuttings is rarely useful for the amateur, in the case of herbaceous perennials, but it is an important commercial method. Plants may be obtained from almost any plant having foliage-stems by taking a short piece of the growing wood with a bud, either lateral or terminal, and placing the lower end in moist sand or other material suitable for root-growth. It is usually necessary to have the lower end of the cutting a node or joint of the stem, and to make the temperature of the material in which it is placed higher than that of the atmosphere (which is the relation of the soil and air in sunshine), and to diminish the evaporation from the exposed parts of the cutting by maintenance of a moist atmosphere and by removal in part of the foliage on the cutting. Some experience will be necessary to know the best temperatures for sand and atmosphere and the most desirable degree of ripeness in the wood to be taken, as they will vary somewhat with species. In general, any cutting of growing wood will form roots in moist sand at a temperature suitable for vigorous root-growth of the plant. See *Cuttings*. Vol. II.

The increase of plants by cuttings has the advantages of being rapid and of allowing the perpetuation of any variation noticed on a portion of any plant.

Whichever method of propagation is used, selection of stock for increase should be practised. If by seed, then the best seed from the best plant should be taken. It is considered that seeds borne the least number of nodes from the root tend to produce dwarfer and earlier-blooming plants, while the opposite is equally certain. All plants vary, and often the seeds that will produce the most striking variations are the slower to germinate and are weaker as seedlings, but any mistreatment of young plants is likely to be against any desirable improvement. The double-flowered and highly colored forms of garden plants are generally the results not only of intercrossing of species or selection, or both, but of intense and perfect culture. A poor, starved plant may not retrograde itself, but it is likely to produce seed which will vary.

1824. A good subject—Yucca filamentosa.

Variations in plants are the result of climatic, soil, cultural, and other conditions, and such plant forms are unstable when the conditions which caused them are radically changed. Any new variety naturally reproduces itself best in the region in which it originated, and may easily revert or otherwise change when grown under different conditions. This is especially true in the reproduction by seed of plant variations. See *Breeding*, Vol. I.

In propagating by division, the aim should be not only to secure vigorous plants but to select for increase such plants as appear to be the best. Cuttings also should be taken from selected plants—and the more so since the method is rapid. F. W. Barclay.

Herbs for the northeastern states.

Selections for special purposes.—The following lists are to be taken as merely suggestive, and are far from being complete. Nearly all are to be found in the American trade.

1. For Moist and Wet Places. Those marked with an asterisk (*) will also thrive under drier conditions.

A. *Near the water's edge.* Actual flooding will not injure any of these.

Acorus japonicus.
Actæa.
Anemone apennina.
Anemone rivularis.
Anemone virginiana.
Caltha palustris.
Carex riparia.
Cyperus alternifolius.
*Cyperus Papyrus.
*Filipendula palmata.
*Filipendula rubra var. venusta.
*Iris Kaempferi.
Iris Pseudacorus.
*Iris sibirica.
*Monarda didyma.
Myosotis palustris.
Peltandra virginica.
Polygonum amphibium.
Polygonum sachalinense.
Pontederia cordata.
Primula pulverulenta.
Ranunculus aquatilis.
Ranunculus fluitans.
Ranunculus graminifolius.
Ranunculus hederaceus.
Ranunculus Lingua var. grandiflorus.
Rheum palmatum.
Rodgersia æsculifolia.
Rumex.
*Thalictrum aquilegifolium.
Typha latifolia.
Zizania aquatica.

AA. *Moist ground preferred.*

*Achillea Ptarmica, The Pearl.
*Aconitum.
Anemone alpina.
Anemone palmata.
*Arenaria balearica.
Arenaria purpurascens.
*Artemisia lactiflora.
Arundo Donax.
Asarum europæum.
Asperula odorata.
*Astilbe Arendsii var. hybrida.
*Astilbe Davidii.
*Astilbe grandis.
*Astilbe rivularis.
*Astilbe Thunbergii.
Astrantia carniolica.
Butomus umbellatus.
Caltha palustris.
Caltha polypetala.
Carex Fraseri.
Carex Gaudichaudiana.
*Chelone.
*Chrysobactron Hookeri.
*Cimicifuga racemosa.
Claytonia virginica.
*Cypripedium acaule.
Cypripedium spectabile.
*Dodecatheon Meadia.
*Doronicum.
Eomecon chionantha.
Epilobium angustifolium.
Epimedium macranthum.
Eryngium aquaticum.
Eupatorium purpureum.
Filipendula camtschatica (Spiræa gigantea).
Filipendula hexapetala.
Gunnera chilensis.
*Heleniums.
Hibiscus Moscheutos.
*Hosta cærulea (Funkia ovata).
*Hosta Sieboldiana.
Houstonia cærulea.
Iris cristata.
Iris Delavayi.
Iris Monnieri.
Iris setosa.
Ligularia.
*Lobelia cardinalis.
*Lobelia syphilitica.
*Lysimachia clethroides.
Lysimachia punctata.
Lysimachia thyrsiflora.
Lythrum.
*Mertensia virginica.
Mimulus cardinalis.
Miscanthus sacchariferus.
Nierembergia rivularis.
*Œnothera fruticosa var. major.
*Œnothera speciosa.
Ourisia coccinea.
Pennisetum latifolium.
*Phlox divaricata.
Podophyllum peltatum.
Polygonatum multiflorum.
Polygonum amphibium.
Polygonum sachalinense.
Polygonum Weyrichii.
Primula japonica.
Primula rosea.
Primula sikkimensis.
Rheum palmatum var. atro-sanguineum.
Rhexia virginica.
Rumex Hydrolapathum.
Sarracenia Drummondii.
Sarracenia purpurea.
*Saxifraga peltata.
*Saxifraga virginiensis.
Senecio clivorum.
Senecio Veitchianus.
Senecio Wilsonianus.
Soldanella alpina.
Spartina cynosuroides var. aureo-marginata.
*Stenanthium robustum.
*Thalictrum adiantifolium.
*Thalictrum dipterocarpum.
*Thalictrum flavum.
Trillium.
*Trollius asiaticus.
Trollius europæus.
*Trollius excelsior.
Trollius giganteus.

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2. For Dry Places. The following plants will grow in dry localities, withstanding considerable neglect and drought. Some are for this reason well adapted for naturalization.

*=*Flower in spring.* †=*Flower in summer.* §=*Flower in autumn.*

*Alyssum saxatile var. compactum.
*Anemone caroliniana.
*Anemone Pulsatilla.
*Antennaria dioica.
†Anthericum Liliago.
*Aquilegia canadensis.
†Asclepias tuberosa.
†§Asters, many kinds.
†§Callirhoë involucrata.
*†Campanula, many kinds.
†Centaurea dealbata.
†Centaurea montana.
†Cerastium tomentosum.
*†Cheiranthus Allionii.
*Cheiranthus alpinus.
*†Cheiranthus, Harpur Crewe.
†Coronilla cappadocica.
§Coronilla varia.
†§Daphne Cneorum.
†Dianthus arenarius.
†Dianthus deltoides.
†Dianthus neglectus.
†Dianthus sylvestris.
†Dictamnus albus.
†Dictamnus albus var. caucasicus.
†Draba azoides.
†Draba pyrenaica.
†Echinops Ritro.
†Echinops sphærocephalus.
*†Erinus alpinus.
†‡Erodium.
*Erysimum pulchellum.
†Euphorbia corollata.
†Euphorbia epithymoides.
†Genista sagittalis.
*†Geranium.
†Geum montanum.
†Gypsophila acutifolia.
†§Gypsophila paniculata.
†Helianthemum. [eriana.
†§Heliopsis lævis var. Pitch-
†§Hemerocallis.
*Hepatica.
†§Hieracium.
*Hutchinsia alpina.
*Iberis sempervirens.
†§Inula.
†Iris germanica.
†Iris pumila.
*Iris unguicularis.
†§Kniphofia.
*Lathyrus (Orobus) vernus.
†Leontopodium alpinum.
†Linarias.
†§Linum perenne.
Muehlenbeckia complexa.
†Œnothera Lamarckiana.
*Ononis rotundifolia.
†§Onopordon bracteatum.
†§Onopordon polycephalum.
*†§Papaver nudicaule.
*Phlox amœna.
*Phlox pilosa.
*Phlox subulata.
†Plantago maxima.
†Platycodon.
†Reseda glauca.
†Rudbeckia laciniata.
†Rudbeckia Newmanii.
†§Saponaria caucasica.
†Saponaria ocymoides.
*Saxifraga.
†§Sedum.
*Sempervivum.
*†Silene.
§Solidago.
§Statice latifolia.
†§Thymus.
†§Tunica Saxifraga.
†Verbascum.
*Vicia (Orobus) oroboides.
†Yucca filamentosa.
†Yucca flaccida.
†Yucca gloriosa.

3. For Shady Places.

A. The following plants require quite heavy shade; many others succeed almost equally well in sunshine and shade.

Anemone alpina.
Anemone canadensis.
Anemone nemorosa.
Anemone rivularis.
Anemone sylvestria.
Cortusa Matthioli.
Cypripedium.
Hepatica.
Horminum pyrenaicum.
Ourisia coccinea.

AA. Doing better in partial shade; a number of them will stand a moderate amount of sunshine.

Actæa spicata.
Adonis amurensis.
Adonis pyrenaica.
Adonis vernalis.
Anemone apennina.
Anemone ranunculoides.
Arnebia echioides.
Arum italicum.
Arum maculatum.
Asarum europæum.
Asperula odorata.
Astilbe.
Astrantia carniolica.
Claytonia virginica.
Convallaria majalis.
Cypripedium.
Digitalis purpurea.
Dodecatheon.
Doronicum.
Goodyera.
Habenaria.
Helleborus niger.
Helleborus niger var. altifolius.
Liparis.
Myosotis alpestris.
Myosotis palustris.
Omphalodes cappadocica.
Omphalodes verna.
Orchis spectabilis.
Polygonatum multiflorum.
Primula.
Ramondia Nathaliæ.
Ramondia pyrenaica.
Ranunculus aconitifolius.
Sanguinaria canadensis.
Saxifraga Camposii.
Saxifraga muscoides.
Saxifraga Rhei.
Spigelia marilandica.
Spiræa.
Tiarella.
Trillium.
Vancouveria hexandra.
Viola canina.
Viola pedata.

4. Suitable for Carpets or Edgings. The following are of compact habit and mostly low; some are also almost continuous bloomers.

Acæna, species.
Achillea Clavenæ.
Achillea tomentosa.
Achillea umbellata.
Æthionema iberidium.
Ajuga reptans.
Alyssum argenteum.
Alyssum saxatile var. compactum.
Arabis albida.
Arabis aubrietioides.
Arenaria balearica.

4. Suitable for Carpets and Edgings, continued.

Arenaria cæspitosa.
Armeria latifolia var. rosea.
Armeria plantaginea var. leucantha.
Armeria vulgaris.
Armeria vulgaris var. Laucheana.
Artemisia lanata.
Asarum europæum.
Aubrietia deltoidea.
Bellis perennis flore-pleno.
Campanula carpatica.
Cerastium tomentosum.
Daphne Cneorum (treated as an herb).
Dianthus cæsius.
Dianthus chinensis.
Dianthus deltoides.
Dianthus sylvestris.
Erodium Manescavi.
Erysimum pulchellum.
Helianthemum mutabile.
Heuchera sanguinea.
Iberis sempervirens.
Lavandula nana var. compacta
Linaria hepaticæfolia.
Myosotis.
Nepeta Mussinii.
Phlox amœna.
Phlox divaricata.
Phlox frondosa.
Phlox ovata.
Phlox reptans.
Phlox subulata.
Polemonium reptans.
Scabiosa graminifolia.
Silene acaulis.
Silene alpestris.
Silene maritima.
Silene Saxifraga.
Silene Schafta.
Tellima grandiflora.
Thymus citriodorus.
Veronica cæspitosa.
Veronica repens.
Veronica rupestris.
Viola cornuta var. alba.
Viola cornuta var. purpurea.

5. For Cut-flowers. The following varieties are well adapted for cutting.

*=*Spring-flowering.* †=*Summer-flowering.* §=*Autumn-flowering.*

†Achillea Ptarmica, The Pearl.
†Achillea Ptarmica, Perry White.
†§Aconitum.
†Alstrœmeria.
§Anemone japonica.
*Anemone sylvestris.
†Anthericum.
†Anthurium.
†Aquilegia.
†Armeria vulgaris var. Laucheana.
§Artemisia lactiflora.
*†§Aster.
†§Astilbe.
*Baptisia australis.
†§Belamcanda chinensis (Pardanthus).
†§Boltonia.
†Campanula latifolia var. macrantha.
†Campanula Medium.
†Campanula persicifolia.
†§Campanula pyramidalis.
†Centaurea montana.
†Centaurea ruthenica.
†§Ceratostigma plumbaginoides.
†Chelone Lyonii.
†§Chrysanthemum maximum, in variety.
‡§Chrysanthemum, Autumn Glory.
†Cimicifuga racemosa.
†Clematis Davidiana.
†Clematis recta.
†Clematis recta flore-pleno.
†Convallaria majalis.
†Coreopsis grandiflora.
†§Delphinium.
*†Dianthus.
*†Dicentra spectabilis.
†Dictamnus albus.
†Digitalis purpurea.
*Doronicum.
†Epilobium angustifolium.
†§Erigeron.
§Eupatorium.
†Euphorbia corollata.
†§Gaillardia aristata.
†Gaillardia grandiflora.
†§Geum coccineum, Mrs. Bradshaw.
†Gypsophila acutifolia.
†Gypsophila paniculata.
†Helleborus niger.
§Helenium autumnale var. superbum.
§Helenium autumnale var. pumilum.
†Helenium Hoopesii.
†§Helianthus.
†§Heliopsis lævis var. Pitcheriana.
†§Hemerocallis.
†§Hesperis matronalis.
†Heuchera sanguinea.
§Hosta plantaginea var. grandiflora.
†§Hypericum Moserianum.
*Iberis sempervirens.
†Incarvillea Delavayi.
†Iris germanica.
†Iris Kaempferi.
†Iris sibirica.
†§Kniphofia (Tritoma).
Lathyrus latifolius.
†§Liatris pycnostachya.
§Lobelia cardinalis.
†§Lobelia syphilitica.
†Lupinus polyphyllus.
†Lychnis.
†§Lysimachia clethroides.
†§Lythrum Salicaria var. roseum superbum.
*†Myosotis.
†Œnothera speciosa.
†Pæonia.
*†Papaver.
†§Pentstemon.
†Phlox Arendsii.
*Phlox divaricata.
†§Phlox paniculata.
†Phlox suffruticosa.
†§Physostegia virginiana.
†Platycodon grandiflorum.
†§Plumbago Larpentæ.
*†Polemonium.
†Potentilla.
*Primula.
†Pyrethrum hybridum.
§Pyrethrum uliginosum.
†Rehmannia angulata.
†§Rudbeckia.
†Salvia azurea.
†Salvia pratensis.
†Saxifraga pyramidalis.
†§Scabiosa caucasica.
§Sedum spectabile.
†Sidalcea candida.
†Sidalcea malvæflora var. Listeri.
§Solidago.
†Spiræa.
†§Statice latifolia.
†§Stokesia cyanea.
†§Thalictrum adiantifolium.
§Thalictrum dipterocarpum.
†Thermopsis caroliniana.
*†Trollius.
†Valeriana officinalis.
Veronica longifolia var. subsessilis.
Veronica spicata.
†Yucca filamentosa.

In addition to the foregoing list, there are a number of other plants usually accepted and often listed as herbaceous plants, such as montbretias, eremurus, lilium, which are suitable for cutting. These will be found under *Bulbs*.

6. For Bold Effects. The following plants are striking in their habit and for this reason are very serviceable in groups or as single specimens. Some are foliage plants with comparatively inconspicuous flowers.

*=*Tall varieties, growing 5 feet or more in height.*
†=*Medium varieties, growing from 2 to 4 feet.*
§=*Varieties with striking foliage.*

*Acanthus mollis var. latifolius.
†Anemone japonica.
†Artemisia lactiflora.
†§Aruncus sylvester.
*Arundo Donax.
*Astilbe Arendsii.
*Astilbe Davidii.
*Astilbe grandis.
§Bambusa.
†Baptisia australis.
†Clematis recta.
*Crambe cordifolia.
*Delphinium hybridum.
†Dictamnus albus.
†Echinacea purpurea (Rudbeckia).
§Elymus glaucus.
§Eryngium amethystinum.
†Filipendula rubra var. ven-
§Gunnera chilensis. [usta
*Helenium autumnale var. superbum.
†Helenium, Riverton Beauty.
*Helianthus mollis.
†Helianthus decapetalus, Soleil d'Or.
*Helianthus orgyalis.
†Hemerocallis aurantiaca var. major.
†Hemerocallis flava.
†Hemerocallis Thunbergii.
§Heracleum villosum.
†§Hosta plantaginea var. grandiflora.
†Hypericum Moserianum.
†Kniphofia Uvaria var. nobilis.
†Kniphofia Pfitzeri.
†Pæonia.
†Papaver orientale.
†Phlox paniculata.
*†Polygonum sachalinense.
*§Polygonum Sieboldii.
§Rheum palmatum var. atrosanguineum.
*§Rodgersia æsculifolia.
*§Rodgersia pinnata.
*Rudbeckia, Golden Glow.
*Rudbeckia maxima.
*Thalictrum dipterocarpum.
†Veronica longifolia var. subsessilis.
*§Yucca filamentosa.

7. For Forcing and Greenhouse Decoration. The following species are suitable for forcing. As a general rule, they succeed best in a temperature not exceeding 50° at night. Many of these can be potted, but some of the more robust sorts are better grown in boxes or benches. The astilbes and spireas will thrive in a higher temperature than other varieties named.

Alyssum saxatile var. com-
Aquilegia cærulea. [pactum.
Aquilegia chrysantha.
Arabis alpina.
Aster alpinus.
Aster subcæruleus.
Astilbe Arendsii.
Astilbe Davidii.
Astilbe grandis.
Aubrietia, all varieties.
Campanula carpatica.
Campanula Medium.
Campanula pyramidalis.
Cheiranthus Allionii.
Cheiranthus alpinus.
Coreopsis grandiflora.
Cypripedium acaule.
Cypripedium pubescens.
Cypripedium spectabile.
Delphinium grandiflorum.
Delphinium hybridum.
Dianthus cæsius.
Dianthus deltoides.
Dianthus, Napoleon III.
Dianthus neglectus.
Dicentra spectabilis.
Digitalis purpurea.
Digitalis purpurea var. gloxiniæflora.
Dodecatheon Meadia.
Francoa ramosus.
Gerbera Jamesonii.
Geum coccineum, Mrs. Bradshaw.
Helleborus niger var. major.
Hepatica angulosa.
Hepatica triloba.
Hesperis matronalis.
Heuchera sanguinea.
Hosta lancifolia var. albomarginata.
Iberis sempervirens.
Incarvillea Delavayi.
Iris cristata.
Iris pumila.
Myosotis, all kinds.
Pæonia, all varieties.
Papaver nudicaule.
Phlox amœna.
Phlox Arendsii.
Phlox divaricata.
Phlox subulata.
Phlox suffruticosa, Miss Lingard.
Polygonatum multiflorum.
Primula, all species.
Pyrethrum hybridum.
Saxifraga, all species.
Sisyrinchium angustifolium.
Spiræa, many species.
Trillium, all species.
Trollius, all species.
Vicia oroboides (Orobus).
Viola, all kinds.

8. New and Very Desirable Species. The following list comprises some of the best introductions of recent years, up to and including 1914.

Achillea Ptarmica, Perry White.
Aconitum Fischeri var. Wilsonii.
Aconitum Hemsleyanum.
Anchusa italica, Dropmore.
Anchusa italica, Opal.
Anchusa italica, Perry variety.
Anchusa myosotidiflora.
Anemone vitifolia.
Arabis aubrietioides.
Artemisia lactiflora.
Aster Amellus, Beauty of Rowdorf.
Aster, Beauty of Colwell.
Aster, Feltham Blue.
Aster novæ-angliæ, L. Fardel.
Aster novi-belgii, St. Egwin.
Aster, Peter White.
Astilbe Arendsii, Ceres.
Astilbe Arendsii, Pink Pearl.
Astilbe Arendsii, Queen Alexandra.
Astilbe Arendsii, Salmon Queen.
Astilbe Arendsii, Vesta.
Campanula carpatica, Kilnfield White.
Campanula, Warley.

8. New and Very Desirable Varieties, continued.

Chrysanthemum, Autumn Glory.
Chrysanthemum maximum, Etoile de Nouvelles.
Chrysanthemum maximum, King Edward VII.
Chrysanthemum maximum, Mrs. Tersteeg.
Chrysanthemum, Rosy Gem.
Clematis recta flore-pleno.
Delphinium Belladonna semi-plena.
Delphinium, J. S. Brunton.
Delphinium, Rev. E. Larcelles.
Delphinium Moerheimei.
Delphinium, Persimmon.
Geum coccineum, Mrs. Bradshaw.
Gypsophila paniculata flore-pleno.
Helenium autumnale, Riverton Beauty.
Helenium autumnale, Riverton Gem.
Heuchera gracillima, Perry var.
Heuchera, Nancy Perry.
Heuchera, Scarlet Spray.
Heuchera, Shirley.
Kniphofia, John Benary.
Kniphofia, Twilight.
Kniphofia, Unique.
Iris germanica, Kashmir White.
Iris germanica, King of Iris.
Iris germanica, Lady Foster.
Iris germanica, Lohengrin.
Iris germanica, Miss Willmott.
Iris interregna, varieties.
Lupinus polyphyllus var. Mœrheimei.
Phlox Arendsii, all varieties.
Phlox paniculata, Frau A. Buchner.
Phlox paniculata, Eliz. Campbell.
Phlox paniculata, Rheinlander.
Phlox paniculata, Rynstrom.
Phlox paniculata, G. A. Strohlein.
Primula Beesiana.
Primula Bulleyana.
Primula Forrestii.
Primula pulverulenta.
Primula sikkimensis.
Primula Veitchii.
Salvia virgata var. nemorosa.
Sedum spectabile, Brilliant.
Senecio clivorum.
Senecio tanguticus.
Thalictrum dipterocarpum.
Viola cornuta var. purpurea.

W. N. Craig.

Herbs in Canada.

Many species and varieties of herbs succeed admirably in Canada, the covering of snow which they have in winter, in most places, affording them excellent protection from extreme cold and sudden changes of temperature. The conditions are thus, in many places, more favorable than farther south, where they are exposed, for long periods, to cold and changeable weather.

Following are lists of best herbaceous perennials.

One hundred best hardy herbaceous perennials for the Dominion of Canada, except prairie provinces.

*=*Best twenty-four.*

Achillea Ptarmica fl.-pl., The Pearl.
Aconitum Fischeri.
Aconitum Napellus var. bicolor.
Adonis vernalis.
Æthionema grandiflorum.
Althæa rosea (Hollyhock).
*Anemone japonica varieties.
Anemone patens var. Nuttalliana.
Anemone sylvestris.
Aquilegia chrysantha.
*Aquilegia cærulea and hybrids.
Aquilegia flabellata var. nana alba.
Aquilegia glandulosa.
Aquilegia oxysepala.
*Arabis albida var. flore-pleno.
Aruncus sylvester var. Kneiffi.
Aster alpinus var. superbus.
Aster Amellus var. amelloides.
Aster Amellus var. bessarabicus.
Aster novæ-angliæ, Mrs. J. F. Rayner.
Campanula carpatica and varieties.
Campanula lactiflora.
Campanula latifolia var. macrantha.
*Campanula persicifolia and varieties.
Campanula pyramidalis.
*Chrysanthemum maximum, varieties.
Cimicifuga americana.
*Clematis recta.
Convallaria majalis.
*Coreopsis grandiflora.
Delphinium Belladonna (a name for garden forms).
Delphinium cashmerianum.
*Delphinium grandiflorum (D. chinense).
*Delphinium hybridum and varieties.
*Dianthus plumarius, Mrs. Sinkins.
*Dicentra spectabilis.
Dictamnus albus.
Doronicum plantagineum var. excelsum.
Echinacea purpurea.
*Epimedium alpinum var. rubrum.
Erigeron speciosus var. superbus.
Filipendula hexapetala var. flore-pleno.
Filipendula rubra.
Gaillardia aristata.
Gypsophila paniculata.
Helenium autumnale var pumilum magnificum.
Helenium autumnale var striatum.
Helenium Hoopesii.
Helianthus multiflorus, Meteor, or Soleil d'Or.
Helianthus multiflorus, Mrs. Moon.
Helianthus rigidus, Miss Mellish.
*Hemerocallis aurantiaca var.
*Hemerocallis flava. [major.
Hemerocallis Thunbergii.
Heuchera brizoides var. gracillima.
Heuchera sanguinea var. splendens.
Hibiscus Moscheutos and varieties.
Hosta plantaginea.
Iberis sempervirens var. Garrexiana.
Iberis sempervirens var. superba, Snowflake.

Hardy herbaceous perennials for the Dominion of Canada, continued.

Incarvillea Delavayi.
Iris aurea.
*Iris germanica, in great variety.
*Iris lævigata (Kaempferi), in great variety.
Lilium auratum.
Lilium croceum, or L. dauricum (davuricum).
Lilium longiflorum.
Lilium speciosum and varieties.
*Lilium superbum.
*Lilium tenuifolium.
Lilium testaceum.
Lilium tigrinum.
Lupinus polyphyllus.
Mertensia virginica.
Monarda didyma.
Myosotis alpestris.
Œnothera fruticosa var. Youngii.
*Pæonia albiflora and P. officinalis, in great variety.
Pæonia tenuifolia var. flore-pleno.
*Papaver nudicaule.
Papaver orientale and varieties.
Phlox amœna.
Phlox divaricata.
Phlox glaberrima var. suffruticosa, Miss Lingard.
*Phlox paniculata (P. decussata), in great variety.
*Platycodon grandiflorum.
Platycodon grandiflorum var. album.
Polemonium humile.
Primula elatior.
*Rudbeckia laciniata fl.-pl., Golden Glow.
Rudbeckia maxima.
Rudbeckia speciosa (R. Newmanii).
Salvia azurea var. grandiflora.
Statice latifolia.
Trillium grandiflorum.
Trollius asiaticus var. plenus.
*Trollius europæus, Orange Globe.
Veronica subsessilis.
Yucca filamentosa.

Best hardy herbaceous perennials for the prairie provinces of Canada.

Achillea Ptarmica fl.-pl., The Pearl.
Aconitum, in variety.
Anemone patens var. Nuttalliana.
Aster novæ-angliæ.
Coreopsis lanceolata.
Delphinium, in variety.
Dianthus, in variety.
Dicentra spectabilis.
Dictamnus albus var. purpureus.
Doronicum caucasicum.
Filipendula Ulmaria.
Gaillardia aristata.
Hemerocallis flava.
Iris germanica, in variety.
Lilium tigrinum.
Pæonia, in variety.
Papaver nudicaule.
Papaver orientale.
Phlox paniculata, in great variety.
Platycodon grandiflorum.
Pyrethrum uliginosum.

W. T. MACOUN.

Western perennials for western gardens.

A leading principle in the prairie style of landscape gardening is restoration of the native flora. The history of every country shows three stages in the development of taste. First, the native flora tends toward extermination by agriculture, drainage, fires, and the growth of cities. Second, cosmopolitanism spreads everywhere, until the gaudiness of temporary plants, like cannas and coleus and the artificiality of complicated geometric beds tends to make all parts of the world look alike. Third, people recognize that the greatest variety and highest beauty come from restoring and intensifying the "local color" originally impressed upon each distinct region by eons of experiment on the part of nature. This "return to nature," which has taken many centuries in Europe has begun in Illinois within a single century, owing largely to the high percentage (89 per cent) of its arable land. The process of banishing native vegetation went so fast and far that, a few years ago, the secretary of the Illinois Horticultural Society declared, "It is probable that no equal area of the earth's surface has been degraded to such utter ugliness and monotony as Illinois." But, in 1906 to 1909, nearly $4,000,000 was spent on the West Side parks of Chicago under the direction of Jens Jensen, with restoration as the leading idea. The largest and most impressive restorations in the Middle West are, "the Prairie River" in Humboldt Park, and "Chicago during the carboniferous era" in the greenhouses at Garfield Park. In all western restorations, perennials are often more important than trees or shrubs, because the former are the characteristic vegetation of prairies, or treeless areas, and because there are more species of western herbs than of western woody plants.

Perennials that do not cross the Alleghanies.—Of the 179 plants that do not cross the Alleghanies, according to Brendel ("Flora Peoriana," pp. 76–78), thirty-four are perennials cultivated for ornament. Of western origin, he thinks, are the following: *Anemone caroliniana, Chrysopsis villosa, Clematis Simsii* (*C. Pitcheri*), *Echinacea angustifolia, Helianthus lætiflorus* and *H. scaberrimus* (*H. rigidus*), *Lithospermum linearifolium* (*L. angustifolium*), *Lythrum alatum, Petalostemon candidus* and *P. violaceus, Camassia esculenta*, (*Quamasia hyacinthina*), and *Solidago glaberrima* (*S. missouriensis*, Hort. not Nutt.). The above came originally from the Great Plains. Of southern origin are: *Amsonia Tabernæmontana* (*A. Amsonia*), *Baptisia leucantha, Boltonia asteroides, Coreopsis lanceolata, Liatris* (or *Lacinaria*) *cylindracea* and *L. pycnostachya, Lepachys* (or *Ratibida*) *pinnata, Rudbeckia subtomentosa* and *R. triloba* (biennial), *Silphium laciniatum, S. perfoliatum*, and *S. terebinthaceum*. The origin of the eleven following species is not stated: *Cypripedium candidum, Echinacea purpurea, Eupatorium altissimum, Filipendula rubra* (*Ulmaria rubra, Spiræa lobata*), *Helianthus doronicoides, Heuchera hispida, Hibiscus militaris, Jeffersonia diphylla, Phlox glaberrima* and *P. maculata*, and *Solidago ohioensis*.

State flowers.—Before a legislature chooses a state flower, lists like the above should be carefully studied by impartial observers, to make sure that the flowers recommended are really characteristic, easy of cultivation, and lend themselves to the decorative arts. When sentiment alone is allowed to decide these matters, plants are often chosen which it is impracticable to grow. Yet, it is a great advantage to choose a flower that can be grown in every garden. One prairie state chose the "prairie violet." Doubtless the showy *Viola sororia* was meant, yet this is a native of the woods, and it is as common East as West. The bird's-foot violet (*V. pedata*) is showy on the dunes, and, even when conventionalized by the decorative arts, would be distinct, but it is not confined to the West. Its western representative (*V. pedatifida*) is a genuine prairie plant, but infrequent and presumably impracticable for cultivation. Unfortunately, *V. sororia* makes its response to good soil by producing leaves instead of flowers.

City flowers.—The western cities have now definitely begun the practice of choosing city flowers to be grown in every yard and woven into their civic art. Perhaps the most appropriate way to symbolize the history or ideals of each locality is to choose a flower characteristic of its peculiar scenery or soil type. The soil type can be determined by correspondence with the Bureau of Soils, United States Department of Agriculture. The prairie states belong chiefly to the Upper Austral zone, but there are a few cities and counties that can choose their public planting motives from the Lower Austral and some from the Transition zones. "Life Zones and Crop Zones," by C. H. Merriam (Bulletin No. 10, Division of Biological Survey), gives the trees characteristic of each zone, and these may be helpful in suggesting the most characteristic plant-associations of each locality. The nearest local botanist will usually give invaluable help.

The best garden perennials.

The following are all sun-loving plants, succeeding in ordinary garden soil without special care. They are arranged according to the month in which they ordinarily begin to bloom, although, of course, considerable variation in season may be expected.

White.—April: *Sanguinaria canadensis*. May: *Phlox divaricata* var. *alba grandiflora*. June: *Anemone canadensis, Pentstemon Cobæa* var. *albus*. July: *Euphorbia corollata, Phlox paniculata* vars. Miss Lingard, Snow Queen, White Queen, Albion, Diadem, Hermione, Helena Vacaresco, and Von Lassburg, *Physostegia virginiana, Thalictrum polygamum*. August: *Boltonia asteroides, Hibiscus Moscheutos* var. *albus, Salvia azurea* var. *alba, Aster ptarmicoides*. September:

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Eupatorium urticæfolium. October: *Aster commutatus. A. ericoides* var. Sensation, *A. Tradescantii.*

Blue.—April: *Iris cristata* and *I. verna, Phlox Stellaria.* May: *Amsonia Tabernæmontana, Baptisia australis, Phlox divaricata, Polemonium reptans, Camassia esculenta.* June: *Tradescantia virginiana, Clitoria mariana.* July: *Delphinium carolinianum* (bluish white). August: *Eupatorium cælestinum.* October: *Aster lævis* and *A. amethystinus.*

Pink.—June: *Tradescantia virginica* var. *delicata.* July: *Phlox paniculata* vars. Grévin, Lady Molly, Sonnenkind, and Le Soleil, *Echinacea purpurea* var. *rosea* (*Rudbeckia elegans rosea*), *Physostegia virginiana* var. *speciosa.* August: *Hisbiscus Moscheutos* and *H. militaris.* September: *Boltonia asteroides, Aster longifolius, A. ericoides* var. Sensation, *A. novæ-angliæ* var. Ryecroft Pink, *A. paniculatus* var. Triumph.

Rose and rosy purple.—July: *Physostegia virginiana.* August: *Liatris* (*Lacinaria*) *pycnostachya, L. scariosa,* and *L. squarrosa.* September and October: *Aster novæangliæ* var. *roseus, Lythrum alatum.*

Purple and violet.—May: *Clematis Simsii* (*C. Pitcheri*), *Sedum pulchellum.* July: *Phlox paniculata* var. Ryecroft Purple, *Echinacea purpurea.* August: *Aster Shortii.* September: *Aster patens.*

Crimson.—June: *Callirhoë involucrata.* July: *Phlox paniculata* var. Lord Kelvin. September: *Aster novæangliæ* var. *coccineus.*

Magenta.—May: *Phlox pilosa, P. stolonifera* (*P. reptans*). June: *Phlox glaberrima, P. maculata.* July: *Phlox paniculata* vars. Champs Elysées, Eclaireur and Obergärtner Wittig.

Scarlet.—May: *Aquilegia canadensis.* June: *Lilium canadense* var. *rubrum, L. umbellatum,* Pursh. not Hort. July: *Pentstemon barbatus* var. *Torreyi* (from the Great Plains), *Phlox paniculata* var. Stendahl, *Lilium canadense* var. *rubrum.* August: *Gaillardia aristata* var. Glory.

Yellow.—May: *Caltha palustris* var. *flore-pleno, Aquilegia canadensis* var. *flavescens, Ranunculus repens* var. *flore-pleno, Viola Nuttallii.* June: *Œnothera missouriensis, Lepachys pinnata, Baptisia tinctoria, Coreopsis lanceolata* and *C. grandiflora.* July: *Coreopsis verticillata, Helianthus mollis, H. lætiflorus* and *H. strumosus* (*H. macrophyllus*), *Silphium perfoliatum, Chrysopsis villosa, Asclepias tuberosa, Rudbeckia speciosa* and *R. Newmanii, Heliopsis helianthoides, H. lævis* and var. *Pitcheriana, H. scabra* var. *zinniæflora.* August: *Rudbeckia fulgida* and *R. sublomentosa, Coreopsis tripteris, Helenium autumnale* and var. *pumilum magnificum, Helianthus decapetalus* vars. *multiflorus, maximus,* and Soleil d' Or, *Helianthus scaberrimus* (*H. rigidus*) var. Miss Mellish. September: *Helianthus orgyalis.* October: *Helianthus Maximilianii.*

Orange.—May: *Lithospermum canescens.* July: *Asclepias tuberosa.*

Perennials classified by height.—It is easy to get flowers of medium height any month from the color lists given above. The prairie has also produced many tall perennials suitable for gardens, especially in the genera Helenium and Helianthus, which furnish many species that grow taller than a man. Many asters and the boltonias will attain 5 feet under favorable conditions, and so will *Lilium canadense* and *L. superbum,* if they have shade and unfailing moisture. The prairie has produced no edging plants equal to the pinks, alyssums, or rock cresses. Perhaps the best western garden plants growing 12 inches high or less are: April: *Iris cristata* and *I. verna, Sanguinaria canadensis.* May: *Fragaria virginiana* var. *illinoiensis, Lithospermum canescens, Ranunculus repens* var. *flore-pleno.* June: *Sedum pulchellum* and *S. ternatum, Œnothera missouriensis, Callirhoë involucrata,* and the plant known to the trade as *Erigeron glabellus,* which blooms in October, and is presumably different from the spring-blooming *Erigeron asper,* to which *E. glabellus* has been referred (although some retain *E. asper* as a synonym of *E. glabellus*).

Perennials for special uses and soils.

Perennials for cut-flowers.—The ideal subject for cutting lasts a long time, has long stems, is fragrant, and has large or numerous flowers. About the only perennial that comes up to this standard is the garden phlox, but long stems and large flowers are produced by many species of Gaillardia, Helianthus, Heliopsis, and Rudbeckia. Smaller flowers in abundance are produced by Aster, Boltonia, and Coreopsis. Long and effective spikes are produced by Liatris, and Physostegia. For lightening bouquets, *Galium boreale* is an excellent substitute for *Gypsophila paniculata.*

Perennials for fragrance.—The phloxes are fragrant at dusk, but otherwise the prairie seems to have produced no fragrant flowers of the first importance for cultivation.

Perennials for the collector.—The groups that appeal most to collectors are those having the greatest variety in form, color, and size. Perennial phlox (*P. paniculata*) has produced more varieties in cultivation than any other American flower, one Scotch catalogue offering 346 kinds. The color range is from purple through crimson-pink to white, and the chief forms are the large-flowered, large-trussed, and halo. *Gaillardia aristata* has produced 102 varieties, ranging from yellow to red, the chief forms being toothed, laciniate, quilled, and reflexed, with some double varieties (e.g. *G. splendidissima plena*) and a maximum size of 5½ inches (James Kelway). The perennial sunflowers make a very impressive collection, but require much space unless only a few of each kind are grown. They are all yellow-flowered, and offer no great variety of form but they vary in season from July to October, and in height from 3 to 12 feet, with single or double flowers and yellow or brown disks. The best twelve species of sunflower are native to the prairie. The coneflowers (comprising Rudbeckia and Lepachys) make a more elegant and varied collection with a wider range of color, the prominent disks being green, yellow, brown, or purple, while the rays range from yellow to reddish brown and purple. Thirty-nine species and seventy-one varieties of perennial asters or Michælmas daisies are offered by a single English dealer. There are thirty-nine species native to the prairie, and in cultivation. The New Jersey aster (*A. novi-belgii*), which is not native to the prairie, has produced the greatest number of varieties, viz., forty-five. Asters are more satisfactory in borders by themselves than in the garden.

Perennials for light soils.—All the artists of the prairie school have been deeply influenced by the sand-dunes near Chicago, to which the Prairie Club has conducted several hundred excursions. The flowers of the dunes have been introduced into the gardens of Chicago, a large part of which is built on dunes. In perhaps a third of the city, the conventional material of the nurseries fails to give satisfaction, but the plants of the dunes succeed admirably. The greatest color shows at the dunes are produced by *Lupinus perennis* and *Viola pedata,* which bloom by the thousands in sand, but commonly fail in rich soil. Other showy perennials of these and other inland dunes are, *Asclepias tuberosa, Euphorbia corollata, Liatris scariosa, Lathyrus maritimus, Lithospermum canescens,* the fleshy-leaved *Solidago Virgaurea, Tephrosia virginica,* and *Physostegia virginiana,* which assumes fleshy leaves and dwarf habit in sand. One of the best grasses is *Calamovilfa longifolia,* and one of the best gray-leaved plants is *Artemisia canadensis.*

Perennials for the roadside.—The greatest opportunity for the public use of perennials in the prairie states is connected with the roadsides, which can be turned into a public park without the cost of buying the land.

LIII. Good use of spring flowers.—Mertensia virginica.

The roadside is the chief sanctuary of the native flora, and if the movement to preserve and restore the prairie flowers has progressed farther in the prairie states than others it may be because the prairie states must, to a great extent, create their own scenery. The following list contains very characteristic and beautiful flowers that can be bought or collected cheaply, and are easy of cultivation, but not weedy. Many of them are excellent for cut-flowers, but few of them would be likely to encourage vandalism. To this list should be added three important bulbous plants which can be used to edge the shrubbery, viz., dodecatheon, mertensia, and camassia. The following plants are all sun-loving species, and most are well adapted to stand drought: May: *Phlox divaricata*. June: *Callirhoë involucrata, Tradescantia virginica, Phlox glaberrima* and *P. maculata, Eryngium aquaticum*. July: *Phlox paniculata, Echinacea purpurea, Helianthus mollis, H. lætiflorus, H. helianthoides, Asclepias tuberosa, Rudbeckia speciosa, Heliopsis scabra*. August: *Gaillardia aristata, Boltonia asteroides, Liatris pycnostachya, Aster novæ-angliæ, Rudbeckia subtomentosa, Helenium autumnale, Helianthus decapetalus*. September: *Aster ericoides, A. paniculatus*, and *A. patens, Helianthus orgyalis*. October: *Aster amethystinus, A. lævis*, and *A. commutatus, A. Tradescantii, Helianthus Maximilianii*.

Perennials for shade.—A great problem in the prairie states is restoration of wild flowers to woodlots that have been pastured. The chief wooded areas are along streams and whenever they exist elsewhere they furnish the only scenic foil to, or relief from, the prairie. The western woods are scarcely differentiated from the eastern woods in spring unless by greater abundance of American bluebells (*Mertensia virginica*), and wild blue phlox (*P. divaricata*). The snow or early wake-robin (*Trillium nivale*) is often the first flower, preceding the hepaticas. Perhaps the most characteristic spring wild flower of the woods is *Erythronium albidum*, which replaces the yellow adder's-tongue of the East. In summer, the most characteristic species, probably, are *Helianthus decapetalus* and *H. divaricatus*. *Lilium canadense* and *L. superbum* grow taller and produce more flowers in moist woods than open places. At the edge of the woods, *Anemone virginiana* and *A. canadensis* bloom freely. Phloxes appear to much better advantage in woods where their magenta color is toned down by the shade, especially when they are seen amid grass. The best planting policy ordinarily is to spend money chiefly near the trails, a favorite foliage plant beside trails being the maidenhair fern (*Adiantum pedatum*). Perhaps the best large masses of color are produced by colonies of *Cimicifuga racemosa* and *Aralia racemosa*, the berries of which change from green through purple to scarlet during the summer.

In autumn, many species of aster and goldenrod fill the woods, notably *Aster cordifolius* and *A. divaricatus*, and *Solidago cæsia*.

Perennials for rock-gardens.—Natural rocks are so rare in the West that rock-gardens hardly seem appropriate. Among the best flowers native to western rocks are *Aquilegia canadensis, Campanula rotundifolia, Eupatorium cœlestinum, Fragaria virginiana* var. *illinoiensis, Heuchera americana, Oxalis violacea, Sedum pulchellum* and *S. ternatum*, and *Silene virginica*.

Perennials for bog-gardens.—Sphagnum bogs in convenient locations are getting rare in the West, but western people are beginning to buy them because they contain some of the most beautiful flowers, especially orchids, pitcher-plants, and members of the heath family. Many of these plants and the fringed gentian require sphagnum moss or peat. They present a higher type of beauty than the plants that grow in ordinary muck or wet soil, which are named in the next list.

Water-loving perennials.—The following are suitable for the margins of ponds, lakes, brooks, rivers, and water-gardens. They require more water than it is convenient to give them in ordinary flower-gardens, and even if they thrive they are likely to look out of place: April: *Caltha palustris*. May: *Chamælirium luteum, Senecio aureus, Menyanthes trifoliata*. June: *Iris versicolor, Parnassia caroliniania, Angelica atropurpurea*. July: *Angelica hirsuta, Aster puniceus, Caltha palustris, Lilium canadense* and *L. superbum, Thalictrum polygamum* (*T. Cornuti*). August: *Lobelia cardinalis, Aster paniculatus, Eupatorium purpureum, Hibiscus Moscheutos*. September: *Gentiana Andrewsii, Helenium autumnale, Pontederia cordata*. October: *Helianthus orgyalis* and *H. Maximilianii*. Colored water-lilies are not used in the prairie style of landscape gardening as they spoil the purity of the composition, since the white water-lily is the only one native to prairie rivers. Perhaps the finest aquatic plant yet to be naturalized in western water-gardens is the yellow lotus (*Nelumbo lutea*).

Bird-pools.—Few, if any, perennials are worth planting around bird-pools to furnish food, but water-loving perennials are important for finishing such compositions. Where the gardenesque style uses German or Japanese iris, variegated calamus, eulalia, and eastern cattail, the prairie style uses *Iris versicolor*, green calamus, bluejoint (*Calamagrostis canadensis*), and western cattail (*Typha angustifolia*). Several wild flowers of the lily family suggest the flight of birds by their habit, e.g., *Polygonatum giganteum*. In the prairie school, the motive is often to reproduce something like the characteristic local spring. Among the original plants native to springs which Brendel records are, *Archangelica atropurpurea, Aster corymbosus* and *A. umbellatus, Caltha palustris, Parnassia caroliniana, Cypripedium spectabile* and *C. candidum*, the last of which is distinctly western.

Bibliography.—H. C. Cowles, "The Plant Societies of Chicago and Vicinity" (1901); Frederick Brendel, "Flora Peoriana (1887); Brendel in Fred Gerhard, "Illinois as It Is" (1857), pp. 271–8; H. A. Gleason, "A Botanical Survey of the Illinois River Valley Sand Region" in Bot. Gaz. 7:149–194 (1907); and "The Vegetation of the Inland Sand Deposits of Illinois," Bull. Ill. State. Lab. Nat. Hist. 9:23–171 (1910).

WILHELM MILLER,
L. E. FOGLESONG and
FRANZ A. AUST.

Perennial herbs for the South.

1. *Piedmont Zone* extends from the Mountain Zone to the "Fall Line," which follows approximately the following cities: Weldon and Raleigh, North Carolina; Camden and Columbia, South Carolina; Augusta, Milledgeville, Macon and Columbus, Georgia; Montgomery, Alabama; Columbus and Holly Springs, Mississippi.

Sun-loving plants for Piedmont Zone.

Acanthus mollis.	Baptisia australis.
Achillea Millefolium.	Belamcanda chinensis.
Adonis vernalis.	Bocconia cordata.
Agave.	Boltonia.
Alyssum saxatile.	Caladium esculentum.
Amaryllis.	Callirhoë involucrata.
Anchusa italica.	Campanula.
Anemone japonica.	Canna.
Anthemis tinctoria.	Centaurea.
Antigonon leptopus.	Chrysanthemums.
Aquilegia.	Clematis.
Arabis alpina.	Clerodendron macrosiphon.
Arenaria grandiflora.	Coreopsis lanceolata.
Armeria vulgaris.	Coronilla.
Artemisia.	Crinum.
Arundo Donax.	Dahlia.
Asclepias.	Dianthus barbatus.
Asters, grandiflorus, etc.	Dianthus deltoides.
Astilbe chinensis.	Dianthus latifolius.
Astilbe japonica.	Dianthus plumarius.
*Astragalus tennesseensis.	Dictamnus albus.
Bamboo.	

**Astragalus tennesseensis*, Gray, from Tenn. and Ala. Hirsute: fls. in a short spike or head, cream-color, often tinged with purple: fr. pointed, strongly wrinkled. April, May.

Sun-loving plants, continued.

Digitalis.
Dioscorea. Climber.
Dolichos. Climber.
Doronicum plantagineum var. excelsum.
Echinacea purpurea.
Erianthus.
Eryngium amethystinum.
Erythrina herbacea.
Eulalia (Miscanthus).
Eupatorium.
Euphorbia corollata.
Festuca glauca.
Gaillardia.
Geranium maculatum.
Gilia coronopifolia.
Gynerium (Cortaderia).
Gypsophila.
Helenium.
Helianthus.
Heliopsis lævis.
Hemerocallis.
Heuchera sanguinea.
Hibiscus.
Hosta (Funkia).
Hydrangea.
Iberis.
Incarvillea Delavayi.
Indigofera decora.
Ipomœa.
Iris germanica.
Iris verna.
Lathyrus latifolius.
Lavandula vera.
Lespedeza japonica.
Lespedeza Sieboldii.
Liatris.
Lilium.
Linum perenne.
Liriope spicata.
Lupinus polyphyllus.
Lychnis.
Lysimachia clethroides.
Malvaviscus Drummondii.
Marshallia.
Monarda didyma.
Montbretia.
Nierembergia rivularis.
Œnothera.
Oxalis. [Ground cover.
Pachysandra terminalis.
Pæonia.
Papaver orientale.
Pennisetum longistylum.
Pentstemon.
Phalaris.
Phlox amœna.
Phlox decussata.
Phlox divaricata.
Phlox paniculata.
Phlox subulata.
Physalis.
Physostegia virginiana.
Platycodon.
Plumbago Larpentæ.
Polygonum Sieboldii.
Pyrethrum uliginosum.
Rudbeckia.
Salvia azurea.
Salvia Greggii.
Salvia Pitcheri.
Santolina.
Saxifraga crassifolia.
Scabiosa.
Sedum acre.
Sempervivum.
Silene Schafta.
Silene virginica.
Solidago.
Spiræa chinensis.
Stachys lanata.
Stokesia.
Thalictrum aquilegifolium.
Thermopsis fabacea.
Thymus carnosus.
Tradescantia.
Tritoma (Kniphofia).
Trollius caucasicus.
Tunica Saxifraga.
Veronica incana.
Veronica longifolia.
Vinca.
Viola.
Yucca.

Shade-loving plants for Piedmont.

Aconitum.
Ægopodium.
Agapanthus umbellatus.
Allium.
Amaryllis.
Amsonia angustifolia.
*Amsonia ciliata.
Apios tuberosa. Climber.
Aquilegia.
Arundo Donax.
Asarum.
Asperula.
Aster corymbosus.
Aster macrophyllus. Hardy native.
Bambusa.
Boltonia asteroides.
Carex (weedy).
Clematis crispa. Climber.
Coreopsis.
Crinum.
Cypripedium.
Delphinium.
Dicentra.
Digitalis purpurea.
Dodecatheon.
Erythronium.
Eulalia (Miscanthus).
Eupatorium.
Gentiana.
Geranium maculatum.
Hepatica.
Heuchera.
Hosta (Funkia).
Iberis sempervirens.
Iris.
Lilium tigrinum.
Linaria Cymbalaria.
Liriope spicata.
Lobelia cardinalis.
Lysimachia nummularia. Ground-cover.
Mentha spicata.
Mitchella repens.
Myosotis.
Oxalis.
Pachysandra.
Pæonia.
Phlox maculata.
Phlox reptans.
Podophyllum peltatum.
Polemonium.
Polygonatum.
Rhexia virginica.
Sanguinaria.
Saxifraga crassifolia.
Spigelia marilandica.
Tradescantia.
Trillium.
Vinca.
Viola.
Waldsteinia lobata.

**Amsonia ciliata*, Walt., from N. C. and Ark. to Fla. and Texas. Sts. and branches pubescent: lvs. numerous: calyx-lobes acute; corolla glabrous.

Bog- and moisture-loving plants for Piedmont.

Acorus Calamus.
Agapanthus umbellatus.
Amaryllis.
Apios tuberosa. Climber.
Arundo Donax.
Asarum.
Asclepias incarnata.
Aster puniceus.
Aster surculosus.
Bambusa.
Boltonia asteroides.
Calopogon pulchellus.
Carex.
Chelone glabra.
Cyperus.
Eriophorum polystachyon.
Eriophorum virginicum.
Eulalia (Miscanthus).
Eupatorium purpureum.
Gynerium (Cortaderia).
Habenaria blepharioglottis.
Habenaria ciliaris.
Helonias bullata.
Hibiscus incanus.
Hibiscus Moscheutos.
Houstonia.
Iris hexagona.
Iris lævigata.
Iris versicolor.
Lilium tigrinum.
Lobelia cardinalis.
Lobelia syphilitica.
Lythrum.
Mertensia.
Myosotis.
Pancratium.
Pogonia ophioglossoides.
Rhexia virginica.
Sagittaria.
Saururus cernuus.
Solidago patula.
Stenanthium robustum.
Thalictrum.
Typha latifolia.

2. *Coastal Zone* extends from the "Fall Line" as outlined under the Piedmont Zone (p. 1471) to the Atlantic Ocean and Gulf of Mexico, but exclusive of Florida south of a line drawn across the state from St. Augustine to Cedar Keys.

Sun-loving plants for Coastal Zone.

Achillea.
Agave.
Alocasia macrorhiza.
Aloe arborescens.
Althæa rosea.
Alyssum saxatile.
Amaryllis.
Amsonia angustifolia.
Anchusa italica.
Antigonon leptopus. Climber.
Armeria vulgaris.
Artemisia.
Arundo Donax.
Asclepias.
Aster.
Asystasia bella.
Bamboo.
Baptisia australis.
Belamcanda chinensis.
Bellis perennis.
Bocconia cordata.
Boltonia.
Caladium esculentum.
Callirhoë involucrata.
Canna.
Capsicum baccatum.
Centaurea.
Chrysanthemum.
Clerodendron fœtidum.
Clerodendron fragrans.
Clerodendron macrosiphon.
Clerodendron Siphonanthus.
Clerodendron trichotomum.
Colocasia.
Coreopsis lanceolata.
Crinum.
Dahlia.
Delphinium.
Desmodium pendulifolium.
Dianthus barbatus.
Dianthus deltoides.
Dianthus latifolius.
Dianthus plumarius.
Digitalis.
Dioscorea. Climber.
Dolichos. Climber.
Echinacea purpurea.
Erianthus.
Eryngium amethystinum.
Erythrina Crista-galli.
Eulalia (Miscanthus).
Eupatorium.
Euphorbia corollata.
Euphorbia splendens.
Furcræa.
Gaillardia.
Gilia coronopifolia.
Gynerium.
Hedychium coronarium.
Helenium.
Helianthus.
Hemerocallis.
Hibiscus.
Hosta (Funkia).
Hydrangea.
Hymenocallis caribæa.
Ipomœa. Climber.
Iris germanica.
Kaempferia Gilbertii.
Lantana.
Lathyrus latifolius.
Leonotis Leonurus.
Lespedeza japonica.
Liatris.
Lippia citriodora.
Liriope spicata.
Lupinus villosus.
Lynchis.
Malvaviscus arboreus.
Malvaviscus Drummondii.
Mirabilis Jalapa.
Montbretia.
Morœa iridoides.
Œnothera.
Oxalis.
Pancratium.
Papaver orientale.
Pennisetum longistylum.
Phalaris.
Phlox amœna.
Phlox decussata.
Physostegia virginiana.
Platycodon.
Plumbago capensis.
Plumbago Larpentæ.
Polygonella ericoides.
Polygonum cuspidatum.
Reineckia carnea.
Richardia africana.
Rudbeckia.
Salvia azurea.
Salvia Greggii.
Salvia Pitcheri.
Santolina.
Scabiosa.
Silene Schafta.
Solidago.
Statice latifolia.
Stokesia.
Thymus carnosus.
Tradescantia.
Tritoma (Kniphofia).
Verbena.
Vinca.
Viola.
Xanthosoma bataviensis.
Xanthosoma violaceum.
Yucca.

Shade-loving plants for Coastal Zone.

Aconitum.
Agave.
Amaryllis.
Anemone.
Anthemis.
Aquilegia.
Asclepias incarnata.
Astilbe.
Caladium.
Caltha.
Canna.
Chrysanthemum maximum.
Coreopsis.
Crinum.
Euphorbia.
Gaillardia.
Hedychium coronarium.
Hemerocallis.
Hibiscus, Mallows.
Hosta (Funkia).
Hymenocallis.
Iris verna.
Lantana.
Liatris gracilis.
Lilium.
Lobelia cardinalis.
Œnothera.
Papaver orientale.
Phlox decussata.
Physalis.
Plumbago.
Pyrethrum.
Rudbeckia.
Sagittaria.
Sanguinaria.
Sedum.
Solidago.

Shade-loving plants, continued.

Stokesia cyanea.
Tradescantia.
Trillium.
Tritoma (Kniphofia).
Vinca.
Viola.
Xanthosoma.

Plants for the seaside.

Armeria.
Aster carolinianus.
Eryngium amethystinum.
Eryngium planum.
Hibiscus coccineus.
Hibiscus grandiflorus.
Hibiscus militaris (H. carolinensis, Muhl.).
Ipomœa dissecta.
Ipomœa Jalapa.
Ipomœa Pes-capræ.
Kosteletzkya virginica.
Rosmarinus.
Solidago sempervirens.
Statice latifolia.
Tradescantia virginica.

Bog- and moisture-loving plants for Coastal Zone.

Asclepias lanceolata.
Aster carolinianus.
Brunella grandiflora.
Calopogon.
Castilleja.
Coreopsis integrifolia*.
Eichhornia.
Gerardia.
Habenaria ciliaris.
Hedychium.
Hibiscus.
Hydrophyllum.
Hymenocallis lacera.
Iris versicolor.
Liatris graminifolia.
Liatris spicata.
Limodorum multiflorum.
Lobelia cardinalis.
Lobelia syphilitica.
Nelumbo.
Nymphæa.
Pogonia.
Pontederia.
Rhexia.
Sabbatia.
Sagittaria.
Sarracenia.
Zephyranthes Atamasco.
Zingiber.

**Coreópsis integrifólia*, Poir. Perennial, 2–3 ft.: lvs. opposite, entire; heads 1–1½ in. broad including rays, the ray-fls. about 8. Ga. and Fla.

3. *Mountain*, or *Upper Zone* includes all the territory above Salem, Morgantown, and Rutherfordton, North Carolina; Spartanburg and Pendelton, South Carolina; Gainesville and Cartersville, Georgia; Huntsville, Alabama; and Murfreesboro, Tennessee; thence north to the Kentucky line.

Shade-loving plants for Mountain Zone.

Aconitum species.
Actæa alba.
Adonis species.
Ajuga species.
Alstrœmeria aurantiaca.
Anemone species.
Aquilegia species.
Aralia nudicaulis.
Arisæma Dracontium.
Arisæma triphyllum.
Aruncus.
Asarum species.
Asclepias.
Asperula odorata.
Asphodelus.
Aster species.
Astilbe biternata.
Aubrietia species.
Boykinia aconitifolia.
Buphthalmum salicifolium.
Calopogon pulchellus.
Campanula species.
Carex species.
Cerastium species.
Chimaphila maculata.
Cimicifuga species.
Clintonia species.
Convallaria majalis.
Coreopsis pubescens.
Cypripedium.
Delphinium species.
Dicentra species.
Dictamnus albus.
Digitalis species.
Diphylleia cymosa.
Dodecatheon Meadia.
Doronicum species.
Epigæa repens.
Epilobium angustifolium.
Epimedium species.
Erythronium species.
Eupatorium species.
Ferns.
Galax aphylla. [bilis.
Galeorchis (Orchis) spectaGaultheria procumbens.
Gentiana species.
Geum species.
Gillenia stipulata.
Gillenia trifoliata.
Glechoma.
Goodyera pubescens.
Gynerium (Cortaderia).
Habenaria ciliaris.
Helleborus.
Hemerocallis species.
Hepatica species.
Hesperis matronalis.
Heuchera species.
Hosta (Funkia) species.
Houstonia serpyllifolia.
Incarvillea Delavayi.
Iris species.
Jasione perennis.
Jeffersonia diphylla.
Liatris species.
Lilium species.
Linaria Cymbalaria.
Linum perenne.
Liriope spicata.
Lobelia species.
Lychnis species.
Lysimachia species.
Mentha species.
Mertensia virginica.
Mitchella repens.
Monarda didyma.
Montbretia.
Myosotis palustris.
Nierembergia rivularis.
Œnothera species.
Opuntia.
Ornithogalum umbellatum.
Platycodon species.
Podophyllum peltatum.
Polygonatum commutatum (P. giganteum).
Polygonum amplexicaule.
Primula officinalis.
Sanguinaria canadensis.
Santolina Chamæcyparissus.
Saponaria species.
Saxifraga species.
Scutellaria montana.
Sedum species.
Shortia galacifolia.
Silene virginica.
Smilacina racemosa.
Solidago species.
Spigelia marilandica.
Spiræa species.
Streptopus roseus.
Thalictrum species.
Thermopsis caroliniana.
Thermopsis fraxinifolia.
Tiarella cordifolia.

Shade-loving plants, continued

Tradescantia species.
Trautvetteria carolinensis.
Tricyrtis species.
Trillium species.
Trollius species.
Uvularia species.
Veratrum viride.
Vinca.
Viola species.
Xanthorrhiza.

Sun-loving plants for Mountain Zone.

Acanthus.
Achillea species.
Actæa alba.
Adonis species.
Ægopodium Podograria var. variegatum.
Ajuga species.
Aletris farinosa.
Althæa rosea.
Alyssum species.
Amsonia species.
Anaphalis margaritacea.
Anchusa italica.
Angelica hirsuta.
Anthemis species.
Anthericum species.
Aquilegia species.
Arabis alpina.
Arenaria species.
Armeria species.
Artemisia species.
Arundo Donax.
Asclepias species.
Aster species.
Baptisia species.
Belamcanda chinensis.
Bellis perennis (the English Daisy).
Bocconia cordata.
Boltonia species.
Calimeris incisa.
Callirhoë involucrata.
Campanula species.
Caryopteris incana.
Cassia marylandica.
Centaurea species.
Centranthus species.
Cephalaria species.
Cerastium species.
Ceratostigma plumbaginoides.
Chamælirium luteum.
Chrysanthemum, Hardy.
Chrysopsis mariana.
Clematis species.
Coreopsis.
Coronilla varia.
Delphinium species.
Dianthus species.
Dicentra species.
Digitalis species.
Doronicum species.
Echinacea purpurea.
Echinops Ritro.
Eremurus robustus.
Erianthus Ravennæ.
Erigeron species.
Eryngium species.
Eupatorium urticæfolium.
Euphorbia corollata.
Festuca glauca.
Gaillardia grandiflora.
Gentiana.
Geum species.
Gillenia species.
Gypsophila species.
Habenaria ciliaris.
Helenium species.
Helianthemum species.
Helianthus species.
Heliopsis species.
Helleborus.
Hemerocallis.
Heuchera sanguinea.
Hibiscus species.
Hieracium aurantiacum.
Hosta (Funkia) species.
Houstonia serpyllifolia.
Hypericum species.
Hyssopus.
Iberis sempervirens.
Iris species.
Lathyrus (Orobus) vernus.
Lathyrus species.
Lavandula vera.
Lepachys pinnata.
Liatris species.
Lilium species.
Linum species.
Lobelia species.
Lupinus polyphyllus.
Lychnis.
Lysimachia species.
Lythrum species.
Marshallia grandiflora.
Mentha species.
Mertensia virginica.
Miscanthus species.
Molinia (Aira) cærulea.
Monarda didyma.
Œnothera species.
Ophiopogon.
Opuntia.
Origanum vulgare.
Pachysandra.
Pæonia.
Papaver.
Pardanthus.
Pentstemon species.
Phlox.
Physalis.
Physostegia species.
Platycodon species.
Plumbago Larpentæ.
Pogonia species.
Polygonatum giganteum.
Polygonum species.
Potentilla tridentata.
Pulmonaria.
Pyrethrum.
Ranunculus species.
Rhexia virginica.
Rudbeckia species.
Salvia species.
Saxifraga species.
Scabiosa species.
Sedum species.
Sempervivum.
Silene species.
Silphium species.
Sisyrinchium grandiflorum.
Solidago species.
Spigelia marilandica.
Spiræa species.
Stachys species.
Stenanthium robustum.
Stipa pennata.
Stokesia cyanea.
Symphytum asperrimum var. aureo-variegatum.
Tanacetum species.
Thalictrum species.
Thermopsis caroliniana.
Thermopsis fraxinifolia.
Thymus species.
Tradescantia species.
Tritoma (Kniphofia) species.
Tunica Saxifraga.
Valeriana species.
Verbascum olympicum.
Vernonia species.
Veronica species.
Vinca.
Viola species.
Xerophyllum setifolium.
Yucca filamentosa.
Yucca flaccida.

Bog- and moisture-loving plants for Mountain Zone.

Acorus Calamus.
Apios tuberosa.
Asclepias.
Aster puniceus.
Aster surculosus.
Calla palustris.
Calopogon pulchellus.
Caltha palustris.
Chelone species.
Cypripedium spectabile.
Decodon (Nesæa) verticillatus.
Eupatorium purpureum.
Habenaria ciliaris.
Helonias bullata.
Heuchera species.
Hibiscus species.
Houstonia serpyllifolia.
Impatiens pallida.
Iris species.

Bog- and moisture-loving plants, continued.

Liatris species.
Lilium species.
Lobelia species.
Mimulus ringens.
Monarda didyma.
Orontium aquaticum.
Parnassia asarifolia.
Pogonia species.
Rhexia virginica.
Rodgersia podophylla.
Sarracenia species.
Saxifraga species.
Senecio aureus.
Senecio clivorum.
Solidago patula.
Stenanthium robustum.
Symplocarpus fœtidus.
Thalictrum species.
Typha latifolia.
Veratrum viride.
Viola palmata var. cucullata.
Xerophyllum setifolium.

L. A. BERCKMANS.

Herbs for California (mostly perennial).

Border or low edging plants.

The following plants produce the appearance of neatness and finish by more clearly defining edges of beds, walks or drives, and by serving as connecting elements between taller plants and the greensward. In so doing they may also screen the lower, more or less bare leafless stems of other plants.

Achillea santolinoides.
Agrostis nebulosa.
Allium neapolitanum.
Alyssum maritimum.
Alyssum saxatile.
Arabis alpina.
Armeria vulgaris (A. maritima).
Asperula odorata.
Aubrietia deltoidea var. græca.
Aubrietia deltoidea var. Leichtlinii.
Baeria chrysostoma var. gracilis. Thrives in sunshine.
Begonia Erfordii.
Bellis perennis, English Daisy.
Bulbs of various kinds.
Calendula officinalis, Pot Marigold.
Cerastium tomentosum.
Chænostoma hispidum.
Chrysanthemum Tchihatchewii, Turfing Daisy.
Convolvulus mauritanicus.
Dianthus, Pinks.
D. barbatus, Sweet William.
Echinopsis Eyriesii.
Erigeron mucronatus, Mexican Daisy.
Festuca glauca.
Freesia.
Gazania splendens.
Geranium, Ivy.
Geranium, Madam Salleroi.
Godetia, dwarf.
Gypsophila muralis.
Gypsophila paniculata, Baby's Breath.
Helianthemum vulgare var. mutabile, Sun Rose.
Heuchera sanguinea, Coral Bells.
Iberis sempervirens, Evergreen Candytuft.
Impatiens Sultani.
Iresine Lindenii (Achyranthes acuminata).
Iris, small blue.
Kalanchoë flammea.
Lantana, dwarf.
Lobelia Erinus.
Lotus Bertholetii (L. peliorhyncus), Coral Gem.
Mahernia verticillata (M. odorata), Honey Bells.
Marigold, African (Tagetes erecta).
Marigold, French (Tagetes patula).
Mesembryanthemum cordifolium, Dew Plant.
Mignonette (Reseda odorata).
Morœa iridioides, Natal Lily.
Myosotis, Forget-me-not.
Nasturtium, dwarf.
Œnothera ovata, Sun-Cups.
Œnothera rosea, Mexican Primrose.
Omphalodes linifolia.
Ophiopogon japonicus.
Oxalis.
Oxalis cernua.
Oxalis oregana.
Oxalis purpurea.
Oxalis tetraphylla.
Pansy.
Pennisetum villosum (P. longistylum).
Phlox, dwarf.
Portulaca grandiflora, Rose Moss.
Primula.
Primula malacoides, pink.
Santolina Chamæcyparissus, Lavender Cotton.
Sanvitalia procumbens var. flore-pleno.
Saxifraga crassifolia.
Scilla.
Scirpus cernuus. For shade.
Sempervivum globiferum, Hen-and-Chickens.
Specularia Speculum (Campanula Speculum), Venus' Looking-Glass.
Specularia Speculum var. procumbens.
Spergula.
Stachys alpina.
Stachys lanata.
Sweet Pea, Cupid.
Vinca minor.
Viola cornuta.
Viola odorata.
Viola odorata, Marie Louise.
Viola odorata, Princess of Wales.
Zaluzianskya selaginoides (Nycterinia selaginoides).
Zinnia, dwarf.

For dry places.

The following are fairly drought-resistant and may be grown in dry situations, where they will bloom freely with little attention.

Abronia umbellata.
Achillea santolinoides.
Antirrhinum Coulterianum.*
Argemone platyceras.
Artichoke (Cynara Scolymus).

**Antirrhinum Coulterianum*, Benth., of S. Calif., 2–4 ft., has spicate infl and rather large corolla with protuberant yellowish palate; violet-purple or white: the slender branches and the linear or oval lvs. act as support for the plant.

For dry places, continued.

Bidens ferulæfolia*.
Calla lily (Zantedeschia æthiopica).
Cheiranthus Cheiri, Wallflower.
Cistus, Rock-Rose.
Coreopsis lanceolata.
Coreopsis tinctoria.
Cornflower (Centaurea Cyanus).
Cotyledon.
Crassula.
Encelia californica.
Eriogonum fasciculatum.
Eriogonum latifolium.
Eriogonum umbellatum.
Eschscholtsia californica, California Poppy.
Gazania splendens.
Gilia californica.
Gilia chamissonis.
Godetia grandiflora.
Goldenrod (Solidago californica).
Helianthus annuus, Sunflower.
Helichrysum petiolatum.
Heliopsis lævis var. Pitcheriana.
Kniphofia Uvaria, Red-hot-poker Plant.
Layia elegans, Tidy-Tips.
Layia glandulosa, White Daisy.
Lippia repens.
Lupinus arboreus, Yellow Tree Lupin.
Marigold, French and African.
Mentzelia Lindleyi.
Mesembryanthemum.
Mimulus brevipes, Yellow Monkey-Flower.
Mimulus glutinosus, Sticky Monkey-Flower.
Nasturtium (Tropæolum).
Nigella damascena, Love-in-a-Mist.
Ophiopogon japonicus.
Pelargonium.
Pentstemon antirrhinoides.
Pentstemon gloxinioides.
Pentstemon heterophyllus.
Pentstemon spectabilis.
Petunia hybrida.
Phacelia grandiflora.
Phacelia Whitlavia.
Romneya Coulteri, Matilija Poppy.
Romneya trichocalyx.
Salvia carduacea, Thistle Sage.
Sansevieria zeylanica, Bowstring Hemp.
Scabiosa atropurpurea, Mourning Bride.
Sedum acre.
Sedum album.
Sedum Anacampseros.
Sedum nicæense.
Sedum pulchellum.
Sedum spectabile.
Shirley poppies (Papaver Rhœas).
Trichostema lanatum.
Turfing Daisy (Chrysanthemum Tchihatchewii).
Verbenas.
Wild flowers of many kinds.
Zauschneria californica, California Fuchsia.

**Bidens ferulæfolia*, DC., from Mex., although perennial, blooms the first year from seed. It has bright orange-yellow rather small heads, and very finely cut pinnatisect or pinnate lvs., the ultimate segms. small and linear or linear-oblong: plant diffuse, the sts. 16–30 in. long. B.M. 2059.

Cut-flowers and greenery.

The following plants are well adapted for use in a garden when quantities of flowers and greenery are wanted for interior decoration and other purposes.

Adiantum Croweanum.
Adiantum cuneatum.
Adiantum gracillimum.
Adiantum grandiceps.
Allium neapolitanum.
Amaryllis.
Anemone japonica.
Anthemis tinctoria.
Antirrhinum majus, Snapdragon.
Asparagus plumosus.
Asparagus scandens var. deflexus.
Asparagus Sprengeri.
Asperula hexaphylla.
Aster, China.
Bellflower (Campanula).
Bermuda lily (Lilium).
Bidens ferulæfolia.
Bleeding-heart (Dicentra).
Boltonia latisquama.
Brake, common (Pteris aquilina).
Briza maxima.
Bromus brizæformis.
Browallia demissa.
Calceolaria.
Calla lily.
California wild flowers.
Campanula Medium.
Campanula Medium var. calycanthema.
Campanula persicifolia.
Candytuft.
Canna.
Carnation.
Centaurea imperialis, Sweet Sultan.
Chrysanthemum, pompons.
Clarkia.
Coreopsis tinctoria.
Cornflower (Centaurea Cyanus).
Cosmos.
Cyclamen.
Daffodil.
Dahlia.
Delphinium cardinale.
Doronicum caucasicum.
Erythronium.
Eschscholtzia californica, California Poppy.
Euphorbia corollata.
Everlasting flowers.
Felicia amelloides.
Ferns, Maidenhair and Sword-Fern.
Feverfew, double white.
Gaillardia aristata.
Gaillardia aristata var. grandiflora, var. maxima.
Gaillardia picta, Lorenziana, amblyodon.
Galax.
Geranium, scarlet.
Gerbera Jamesonii, Transvaal Daisy.
Geum coccineum.
Gilia liniflora.
Gladiolus.
Godetia.
Goldenrod (Solidago).
Gypsophila paniculata.
Helenium autumnale var. pumilum.
Heliopsis lævis var. Pitcheriana.
Heliotrope (Heliotropium).
Hesperis matronalis.
Heuchera rubescens.
Hollyhock.
Honesty (Lunaria annua).
Hunnemannia fumariæfolia, Mexican Poppy.
Hydrangea hortensis.
Iberis sempervirens.
Indian pink.
Iris.
Iris lævigata (Kaempferi), Japanese Iris.
Ixia.
Kniphofia Uvaria, Red-hot-poker Plant.
Larkspur (Delphinium).

Cut-flowers and greenery, continued.

Lilium Humboldtii.
Lily, Bermuda.
Lily-of-the-Valley (Convallaria majalis).
Maidenhair fern (Adiantum).
Marguerite (Chrysanthemum frutescens).
Marigold, African (Tagetes erecta).
Marigold, French (Tagetes patula).
Mexican ivy (Vancouveria hexandra).
Mignonette (Reseda).
Mimulus.
Myosotis, Forget-me-not.
Narcissus.
Nasturtium (Tropæolum).
Nigella.
Orchids (Cattleya and others).
Panicum atrosanguineum.
Panicum plicatum.
Pansy.
Pentstemon.
Petunia, double and single.
Phlox Drummondii.
Phlox grandiflora.
Pink (Dianthus).
Polygala apopetala.
Poppy.
Russelia juncea var. Lemoinei.
Russelia sarmentosa (R. multiflora).
Salvia azurea var. grandiflora.
Salvia, scarlet.
Scabiosa, Mourning-Bride.
Schizanthus.
Scilla.
Shasta daisy.
Smilax.
Snapdragon (Antirrhinum).
Snowflake (Leucojum).
Statice fruticans (S. arborea).
Statice Suworowi.
Stock.
Sunflower (Helianthus).
Sweet alyssum.
Sweet pea.
Sweet sultan (Centaurea).
Tritonia crocosmæflora.
Tuberose.
Tulip.
Verbena.
Vinca, white with red eyes, pure white.
Violet.
Volutarella muricata (Amberboa muricata).
Water-lily.
Woodwardia.
Zinnia grandiflora.

Herbaceous hedge plants (some of them shrubby).

The following plants range from 1½ to 3 to 4 feet high and may be used to give a profusion of color and brightness to a home place; to make low boundary lines between property lines; partially to hide some disagreeable object; to give a touch of privacy about some garden feature; to plant around a vegetable-garden to make it more attractive; they are very effective treated as temporary plant material.

Achillea santolinoides.
Artichoke (Cynara Scolymus).
Atriplex Breweri.
Calceolaria integrifolia.
Calla lily (Zantedeschia).
Eriogonum fasciculatum.
Feverfew (Chrysanthemum Parthenium).
Fuchsia arborescens.
Fuchsia corymbifolia.
Geranium.
Helichrysum petiolatum (Gnaphalium lanatum).
Heliotrope, Queen Marguerite.
Lantana, Dwarf.
Lantana Sellowiana.
Lavandula vera, Lavender.
Leonotis Leonurus, Lion's-Tail.
Mahernia verticillata, Honey-Bells.
Malvaviscus mollis.
Marguerite (Chrysanthemum frutescens).
Pelargonium.
Rock rose (Cistus).
Rosemary (Rosmarinus officinalis).
Salvia splendens.
Santolina Chamæcyparissus.
Streptosolen Jamesonii.
Teucrium fruticans.
Valerian, red (Centranthus ruber).
White valerian (Centranthus ruber var. albus).

For naturalizing.

Plants that will grow year after year without much attention, and therefore good to naturalize and leave alone.

Aquilegia truncata.
Aquilegia vulgaris var. nivea.
Brodiæa.
Calochortus.
Camassia Cusickii.
Camassia esculenta.
Camassia Leichtlinii.
Ceratostigma plumbaginoides.
Cow parsnip (Heracleum lanatum).
Cynoglossum grande.
Daffodil.
Delphinium nudicaule.
Dicentra spectabilis.
Dwarf bamboo.
Eriogonum.
Erythronium californicum.
Ferns.
Freesia refracta var. alba.
Iris.
Micromeria Chamissonis, Yerba Buena.
Mimulus glutinosus.
Narcissus.
Nierembergia rivularis.
Œnothera ovata.
Pentstemon barbatus var. Torreyi.
Pentstemon, California Blue-Bedder.
Saxifraga crassifolia.

Moist soil, bogs, or edges of water.

For wet grounds, bogs or near edges of water the following have been found to be successful.

Achillea Ptarmica, The Pearl.
Anemopsis californica, Yerba Mansa.
Aquilegia eximia (probably a form of *A. formosa*).
Boykinia occidentalis.*

**Boykinia occidentalis*, Torr. & Gray. Calif. to Wash. Erect or declined 1–2 ft.: lvs. round-cordate, 3–9-lobed: fls. many, the petals white.

Moist soils, bogs, or edges of water, continued.

Calla lily (Zantedeschia).
Calochortus nitidus.
Camassia Cusickii.
Camassia esculenta.
Camassia Leichtlinii.
Cat-tail (Typha latifolia).
Cyperus alternifolius, Umbrella Plant.
Cyperus alternifolius var. gracilis.
Cyperus Papyrus, Papyrus.
Cypripedium californicum, Lady's Slipper. A rare bog-plant.
Dodecatheon Jeffreyi, Shooting Star.
Elephant's Ear (Colocasia antiquorum var. esculenta; Caladium esculentum).
Epipactis Royleana. Banks or in moist soil.
Gunnera chilensis (G. scabra).
Hemerocallis aurantiaca.
Hemerocallis aurantiaca var. major.
Hemerocallis Thunbergii.
Iris lævigata (I. Kaempferi).
Iris orientalis (I. ochroleuca).
Miscanthus sinensis (Eulalia japonica).
Miscanthus sinensis var. gracillimus.
Miscanthus sinensis var. variegatus.
Miscanthus sinensis var. zebrinus.
Nierembergia rivularis.
Pampas-grass (Cortaderia argentea).
Rudbeckia nitida.
Sagittaria sagittæfolia.
Tolmiea Menziesii.
Tule (Scirpus lacustris var. occidentalis).
Water-cress (Nasturtium officinale).

Almost continuous bloomers in some parts of California.

The following plants are almost continuous bloomers; i.e., flowers usually can be had most of the year in most parts of California.

Alyssum maritimum, Sweet Alyssum.
Anchusa capensis.
Begonia Erfordii.
Begonia gracilis.
Begonia semperflorens var. Vernon.
Begonia luminosa (a garden form).
Bidens ferulæfolia.
Canna.
Carnation, Corbett.
Chænostoma hispidum.
Convolvulus floridus or Rhodorhiza florida.
Convolvulus mauritanicus.
Cuphea hyssopifolia.
Cuphea ignea.
Cuphea llavea.
Cuphea micropetala.
Dwarf lantana.
Erigeron mucronatus.
Erigeron speciosus.
Eschscholtzia californica.
Felicia amelloides.
Feverfew (Chrysanthemum Parthenium).
Geraniums, Ivy-leaved, Chas. Turner, Etincelant, Carlos Uhden, Gringoire, Leopard.
Geranium sanguineum.
Gerbera Jamesonii.
Geum, Mrs. Bradshaw.
Heliotrope, La Duse.
Heliotrope, Queen Marguerite.
Hemerocallis aurantiaca.
Hollyhock (Althæa rosea).
Marguerite (Chrysanthemum frutescens).
Pelargonium odoratissimum, Nutmeg Geranium.
Pennisetum Ruppellii.
Pentstemon antirrhinoides.
Pentstemon gloxinioides.
Petunia hybrida.
Primula obconica.
Primula sinensis.
Saxifraga crassifolia.
Shasta daisy.
Snapdragon.
Statice macrophylla.
Stokesia cyanea.
Vinca rosea.

Rock-gardens in shade.

A selection from the following will enable one to bring into the garden some of the dainty beauty of wildwood plants:

Aquilegia.
Asarum caudatum.
Boykinia occidentalis.
Epimedium.
Fuchsia procumbens.
Heuchera micrantha.
Heuchera pilosissima.
Heuchera rubescens.
Heuchera sanguinea.
Linaria Cymbalaria, Kenilworth Ivy.
Micromeria Chamissonis, Yerba Buena.
Myosotis, Forget-me-Not.
Nierembergia rivularis.
Oxalis oregana.
Phlox subulata.
Primula kewensis.
Primula malacoides.
Primula obconica.
Primula sinensis.
Sagina subulata.
Saxifraga crassifolia.
Saxifraga integrifolia.
Saxifraga Mertensiana.
Saxifraga sarmentosa.
Saxifraga umbrosa.
Tellima grandiflora.
Tiarella unifoliata.
Tolmiea Menziesii.
Vancouveria hexandra.
Vancouveria parviflora.

For shady places.

Many plants that grow freely in the direct rays of the sun in middle California, require shade in southern California and must be protected from the fierce summer heat of the Sacramento and San Joaquin valleys. Therefore, plant them under lath-houses or in the shade of trees or on the north side of a house.

Acanthus Caroli-Alexandræ.
Acanthus mollis.
Acanthus mollis var. latifolius.
Acanthus spinosus.
Aconitum, Monkshood.
Agapanthus umbellatus.
Allium neapolitanum.
Alsophila australis.
Alyssum saxatile.
Amomum Cardamon.
Anemone japonica.

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For shady places, continued.

Anemone japonica var. alba.
Anemone coronaria.
Anemone fulgens.
Aquilegia, Columbine.
Asarum caudatum.
Asparagus crispus (A. decumbens).
Asparagus asparagoides, Smilax of florists.
Asparagus plumosus.
Asparagus plumosus var. comorensis.
Asparagus plumosus var. nanus.
Asparagus plumosus var. robustus (A. Hatcheri).
Asparagus plumosus var. tenuissimus.
Asparagus retrofractus.
Asparagus scandens var. deflexus.
Asparagus Sprengeri.
Asperula odorata, Woodruff.
Aspidistra lurida.
Asystasia bella (Mackaya bella).
Balm, Moldavian (Dracocephalum Moldavica).
Begonia argenteo-guttata.
Begonia coccinea (B. rubra).
Begonia Erfordii.
Begonia floribunda (a garden form).
Begonia fuchsioides.
Begonia luminosa.
Begonia Margaritæ.
Begonia nitida var. odorata
Begonia Rex. [alba.
Begonia rosea.
Begonia rubella.
Begonia Sandersonii (B. Digswelliana).
Begonia semperflorens.
Begonia Templinii.
Begonia weltoniensis.
Bellis perennis, English daisy.
Calla lily (Zantedeschia).
Cibotium Barometz, Scythian Lamb.
Cinerarias.
Clivia miniata. It will not stand frost.
Convolvulus mauritanicus.
Crinum Moorei.
Cyclamen.
Cyperus alternifolius.
Cyrtomium falcatum.
Dædalacanthus nervosus.
Daffodil.
Dicentra spectabilis, Bleeding Heart.
Digitalis purpurea, Foxglove.
Dog's-tooth violet (Erythronium californicum).
Doronicum magnificum.
Eremurus Elwesii.
Eremurus himalaicus.
Eremurus robustus.
Erigeron mucronatus.
Felicia amelloides.
Ferns.
Foxglove (Digitalis purpurea).
Haworthia atrovirens.
Haworthia cymbiformis.
Haworthia margaritifera.
Haworthia rugosa.
Helleborus niger, Christmas Rose.
Heuchera micrantha.
Heuchera pilosissima.
Hyacinth.
Linaria Cymbalaria, Kenilworth Ivy.
Kniphofia Uvaria, Red-hot-poker Plant.
Larkspur (Delphinium nudicaule).
Lily (Lilium).
Lily-of-the-Valley (Convallaria majalis).
Mentha piperita.
Mimulus glutinosus.
Myosotis, Forget-me-not.
Nephrolepis exaltata var. bostoniensis.
New Zealand Flax (Phormium tenax).
Œnothera cæspitosa.
Onychium japonicum.
Oxalis oregana.
Pansy (Viola).
Papaver heterophylla.
Pentstemon cordifolius.
Pæonia.
Petasites palmata.
Pilea microphylla, Artillery Plant.
Primula (P. obconica).
Pteris cretica albo-lineata.
Pteris quadriaurita argyræa.
Pteris tremula.
Salvia patens.
Saxifraga crassifolia.
Saxifraga umbrosa.
Senecio Kaempferi aureo-maculatus.
Star Flower (Trientalis europæa var. latifolia).
Star of Bethlehem (Tellima affinis).
Solomon's Seal, False (Smilacina amplexicaulis; also S. sessilifolia).
Thalictrum Delavayi.
Tiarella unifoliata.
Tradescantia fluminensis.
Trillium.
Tulip. Shade one-third to one-half day.
Vancouveria hexandra.
Vancouveria parviflora. For partial shade.
Violet (Viola odorata). For half shade.
Wallflower (Cheiranthus Cheiri). For partial shade.

Rock-gardens in the sun.

For rock-gardens in the sun, many interesting plants may be grown, instead of the more gaudy succulents and curious desert plants.

Alyssum saxatile.
Aubrietia deltoidea var. Leichtlinii.
Calandrinia umbellata.
Cerastium tomentosum.
Chænostoma hispidum.
Convolvulus mauritanicus.
Cotyledon.
Crassula.
Echeveria.
Edelweiss (Leontopodium Eriogonum. [alpinum).
Flax (Linum).
Gazania splendens.
Geranium sanguineum.
Geum chiloense.
Geum coccineum.
Helichrysum petiolatum (Gnaphalium lanatum).
Lewisia Cotyledon.
Lewisia Howellii.
Lewisia Leana.
Lewisia oppositifolia (Calandrinia).
Lewisia rediviva.
Lewisia Tweedyi.
Lychnis Haageana.
Mahernia verticillata.
Nierembergia gracilis.
Œnothera, America.
Œnothera ovata, Sun-Cups.
Othonna capensis.
Pentstemon cæruleus.
Pentstemon Menziesii.
Santolina Chamæcyparissus, Lavender Cotton.
Sanvitalia procumbens.
Sedum.
Statice.
Synthyris rotundifolia.

JOHN WM. GREGG.
R. T. STEVENS.
KATHERINE D. JONES.

HERBÉRTIA (Wm. Herbert, 1778–1847, Dean of Manchester, distinguished botanist, author of "Amaryllidaceæ," and ardent lover of bulbs). *Iridàceæ*. Bulbous plants, native from Texas to Chile and southern Brazil, with fugitive blue or lilac flowers borne in summer; allied to Tigridia.

Stems simple or forking, from a tunicated corm: lvs. mostly basal, few, long and narrow, somewhat folded or plicate: fls. several from a single terminal spathe, pedicelled; perianth showy, without tube and segms. 6 in 2 very unlike series, the inner being much smaller; stamens 3, united by their filaments into a tube; ovary long, 3-celled; styles partially united, the 3 branches forked: fr. an oblong loculicidally 3-valved exserted caps., with many small angled seeds.—About a half-dozen species, of secondary value horticulturally. There is some confusion in the generic name; but the situation is: Herbertia, Sweet, 1827; Alophia, Herbert, 1838; Trifurcia, Herbert, 1840. The herbertias thrive in usual garden soils; sometimes started in coldframes; prop. by seeds and offsets.

pulchélla, Sweet. Bulb or corm globose, ½in. or more thick; tunics brown: lvs. about 4, linear, plaited, 3–6 in. long: spathes 1½ in. long: fls. lilac; outer segms. obovate, with a white claw spotted lilac. Chile, Argentina, Brazil. B.M. 3862.

platénsis, Hort. Franceschi. Bulb or corm very large: lvs. sword-shaped, glaucescent, ribbed, 2 ft. and more long: scapes to 4 ft.; fls. large, light porcelain-blue, produced in 8 months of summer. La Plata.

H. amatòrum, C. H. Wright. Bulb or corm globose, with brown scales: lvs. lanceolate, acuminate, plicate, 8 in. long: scape 18 in., very slender, branched: spathes herbaceous, the inner twice longer than outer: fls. violet; perianth 2 in. across; outer segms. with white midrib inside, 3 times longer than inner, the latter brown-spotted at base. Uruguay.—*H. cærùlea*, Herb.=H. Drummondiana.—*H. Drummondiàna*, Herb. Corm small and ovoid, with brown tunics: st. 1 ft. or less high, simple or forked; fls. blue, 2 in. across; outer segms. obovate, with white claw; inner segms. oblanceolate, acute. Prairies, Texas. B.M. 3862.—*H. Wdtsonii*, Baker. Lower: fls. purple; outer segms. oblanceolate, 1 in.; inner segms. obovate, ¼in. long. Damp prairies, Texas. L. H. B.

HERBS, Pot: *Greens.* **Salad:** *Greens and Salad Plants.*

HERCULES' CLUB: *Aralia spinosa;* also *Zanthoxylum Clava-Herculis.*

HERÍNCQUIA: *Gesneria.* The plant once known in horticultural literature as *H. floribunda* is probably *Gesneria libanensis.*

HERITIÈRA (Charles Louis L'Heritier de Brutelle, 1746–1800, French botanist). *Sterculiàceæ*. About 4 species of trees on the tropical seacoasts of the Old World, little known horticulturally: lvs. thick, simple, entire, silvery or shining beneath: fls. small, unisexual, in axillary panicles; calyx 4–6-toothed or -cleft; petals none; stamens united into a column, bearing 5 anthers at top; ovaries mostly 5, nearly free, bearing short style and 5 stigmas: carpels woody and indehiscent when ripe, cornered, keeled or winged. Called "looking-glass tree," from the shining under-surface of the lvs. *H. littoràlis*, Dry. Moderate-sized tree: lvs. oblong, acute, 3–8 in. long: staminate fls. small, in axillary branched clusters, with an urn-shaped downy calyx; pistillate fls. larger with bell-shaped calyx: carpels or follicles 1–4 in. long, smooth or tubercled. Afr., Asia, Pacific islands. L. H. B.

HERMÁNNIA (Paul Hermann, 1646–1695, botanical traveler, professor of medicine at Leyden). *Sterculiàceæ*. Shrubs, mostly small, growing chiefly in Afr., but a few in Amer. from Texas south, some 150 species in all. They are little known horticulturally. Lvs. alternate, entire, toothed or pinnatifid, sometimes laciniate: fls. many, yellow, orange, cream-color or reddish, on axillary peduncles or panicled; calyx campanulate, 5-cleft, often inflated, without involucre; petals 5, clawed; stamens 5, standing opposite the petals, the filaments joined at the base: fr. a coriaceous 5-celled and 5-valved many-seeded caps. *H. texàna*,

Gray, occurs in dry or rocky places in Texas and adjacent Mex.: 2–4 ft.: lvs. tomentose, suborbicular to oval, serrate or dentate: fls. dull scarlet or crimson. *H. cándicans*, Ait., is a variable species of S. Afr.: erect or diffuse, tomentose: lvs. long-petioled, elliptic or ovate-oblong, obtuse, nearly entire: fls. more or less tomentose, bright yellow, the petals twice as long as calyx. Gn. 71, p. 15, where the name "cowslip bush" is proposed, its fls. closely resembling those of a small cowslip; blooms spring to fall. Other species of Hermannia are likely to be mentioned in horticultural literature. L. H. B.

HERMINIÈRA (name refers to the stout thorns and stamens). *Leguminòsæ*. One species, in Trop. Afr.: by some included in Æschynomene. Fls. papilionaceous; calyx 2-lipped; standard orbicular, short-clawed; wings about equaling the standard, obliquely obovate; keel broad, obtuse or somewhat beaked: pod linear and nearly flat, curved spirally, separating at the square articulations. *H. Elaphróxylon*, Guill. & Perr. (*Æschynómene Elaphróxylon*, Taub.), the ambash or pith-tree of the upper Nile and beyond, may possibly be planted somewhere in our region: erect thorny shrub, to 20 ft.: lvs. bristly; lfts. 10–20 pairs, ½in. or less long, linear-oblong: fls. bright orange, subcorymbose, the peduncles bristly; standard 1½ in. broad. G.W. 14, p. 605.—It grows in wet places, sometimes choking streams. L. H. B.

HERMODÁCTYLUS (Greek, *Mercury's* or *Hermes' fingers;* from the arrangement of the tubers). *Iridàceæ*. Snake's-head Iris. A hardy tuberous plant closely allied to Iris, the fls. purplish black and green, of a quaint and peculiarly attractive beauty. The plant is procurable from European growers. The genus differs from Iris in the 1-celled ovary with 3 parietal placentæ; Iris has a 3-celled ovary: rootstocks digitate.—One species, S. France to Greece. Cult. of the tuberous irises. Flowers April, May.

tuberòsus, Salisb. (*Íris tuberòsa*, Linn.). Tubers 2–4, about 1 in. long: st. 1-fld., 1 ft. or more high: lvs. 2–3, glaucous, 4-angled, 1–2 ft. long: spathe usually with only 1 large lanceolate valve: outer perianth-segms. 2 in. long, black-purple; inner ones green. April. B.M. 531. F.S. 11:1083. G.C. II. 23:672.—*H. longifòlius*, Sweet, is a form, according to Baker, with lvs. 3–4 ft. long; and *H. bispathàceus*, Sweet, a form with 2 valves in the spathe. *H. tuberosus* is sometimes called the "widow iris" or "mourning iris," from its fls. of apple-green and velvet-black. J. N. Gerard. L. H. B.†

HERNÁNDIA (Francisco Hernandez, physician to Philip II of Spain, traveled in West Indies and Mexico, 1593–1600, and wrote on natural history of Mexico). *Hernandiàceæ*, formerly included in *Lauràceæ*. Jack-in-a-Box. Ornamental trees, grown chiefly for their large handsome foliage.

Evergreen: lvs. alternate, long-petioled, often peltate, entire, 3–7-nerved, without stipules: fls. monœcious, small, in loose terminal corymbs or panicles; the extreme branches terminated by 3-fld. cymes with a 4–5-leaved involucre at the base; their central fls. pistillate and sessile, the lateral staminate and stalked; pistillate fls. with a lobed cupula; sepals 8–10; ovary inferior, 1-ovuled; style short, with a large lobed stigma; staminate fls. with 3–4 stamens shorter than the 6–8 sepals: fr. globose, ribbed, indehiscent, inclosed in an inflated often colored involucre.—Eight species in the tropics.

These are handsome trees with large glossy foliage and with small yellowish or greenish white flowers in terminal corymbs followed by yellowish or whitish subglobose or ovoid fruits. *H. sonora* is much used in Europe for subtropical bedding, and produces a juice that removes hairs from the face without pain. *H. ovigera* is cultivated in southern California by Franceschi, who says it has light green, glossy leaves with a red spot in the center, and large, whitish, egg-shaped fruits. Propagation by cuttings of half-ripened wood under glass, which root easily with bottom heat.

sonòra, Linn. Tree, to 60 ft.: lvs. chartaceous, ovate to oblong-ovate, usually peltate, or cordate at the base, acuminate, entire, glabrous, penninerved, 7–12 in. long: corymbs grayish tomentulose; fls. yellowish, ½in. across; stamens 3–4; filaments with 1 gland at the base: fr. ovoid, yellow, about 1 in. long. W. Indies.—The similar *H. Moorenhoutiana*, Guill., from the Pacific islands, has smaller, more coriaceous, palmately 3–5-nerved lvs. and larger fls. ¾in. across. B.M. 5839.

ovígera, Linn. Tree, to 40 ft.: lvs. coriaceous, broadly ovate to ovate-oblong, not peltate, acuminate, subcordate at the base, palmately 7-nerved, glabrous, 4–7 in. long: corymbs grayish tomentulose; filaments with 2 glands at the base: fr. whitish, subglobose, about 1 in. long. Trop. Asia and Afr. Alfred Rehder.

HERNIÀRIA (Greek; supposed to cure hernia or rupture). *Caryophyllàceæ*. Herniary. Rupture-wort. Trailing or sprawling little small-leaved herbs, one of which is grown as a carpeter.

Herniaria has about 15 species, scattered from the Canaries to W. Asia, but all grow in sandy places, chiefly near the sea. It has no near allies of much garden value, but 2 species of Paronychia are cult. for the same purpose and are easily distinguished by general appearance. Herniaria and Paronychia are alike in their 5-parted perianth and 2 stigmas, but in Herniaria the segms. are blunt, while in Paronychia they are hooded near the apex and have a horn or small sharp point on the back near the apex. Herniaria is composed of annuals or perennials with roots of short duration, and they are all much branched, trailing plants, either glabrous or hirsute: lvs. opposite, alternate or clustered, small, entire: fls. minute, crowded in the axils; sepals, petals and stamens 5: seed solitary.

glàbra, Linn. Lvs. obovate, rarely orbicular, glabrous except a few hairs at edges, which are usually recurved: fls. small and green, in a leafy spike or the lower ones at considerable intervals. July, Aug. Eu., Asia.—A hardy herbaceous perennial which grows about 2 in. high and produces inconspicuous greenish fls. in summer. It makes a dense mat of moss-like foliage, which turns a deep bronzy red in winter. It is much used in carpet-bedding and to a less extent in rockeries and for edgings of hardy borders. Recommended for covering graves. It thrives in the poorest soils, makes a solid covering, and is by some regarded as one of the most valuable of hardy trailers. Prop. by division or seed. Grows wild in England, and is kept in many large collections of hardy plants. **H. hirsùta**, Linn., Eu., has narrow hirsute lvs.: sometimes planted. Wilhelm Miller.

HERPÉSTIS (name refers to the creeping habit of some species). *Scrophulariàceæ*. About 60 herbs, mostly of warm and tropical parts of the world, 1 or 2 of which may be transferred to cult. grounds now and then. The name Herpestis is now given up by systematic botanists, the "nomina conservanda" of the Vienna code using Aublet's Bacopa for the genus and others adopting P. Browne's Monniera or Lamarck's Bramia. Allied to Mimulus, but differs in short corolla and in unequally toothed calyx: low herbs, blooming in summer, sometimes rather succulent: lvs. opposite: fls. small, peduncled, mostly solitary in the axils, blue, purple or white; corolla 2-lipped or nearly regular; stamens 4, didynamous, not protruding; style slender; stigma 2-lobed or capitate. *H. Monnièria*, HBK., or *Bacòpa Monnièria*, Wettst., grows near the sea and along river-banks, Md. to Texas and south: glabrous, creeping, perennial, somewhat fleshy: lvs. spatulate to cuneate, entire or

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sparingly toothed, sessile: fls. pale blue, about ½in. long or less, the corolla only obscurely 2-lipped. Other native species with 2-lipped corolla are *H. amplexicaùlis*, Pursh, blue; *H. rotundifòlia*, Pursh, white or pale blue; *H. nigréscens*, Benth., whitish or purplish. L. H. B.

HERPETOSPÉRMUM (name refers to some character of the seeds). *Cucurbitàceæ*. Two annual tendril-climbers, one from the Himalaya region and one from China, allied to Abobra, but differing in the usually racemose sterile fls. and the long-tubular calyx. Lvs. long-petioled, ovate, nearly entire or angled: tendrils bifid: fls. rather large, yellow; corolla broadly campanulate, very deeply parted, the segms. elliptical and entire; stamens 3, included, inserted on calyx-tube, the filaments short and free: fr. medium-size, broadly oblong and 3-angled, costate, more or less 3-valved. *H. grandiflòrum*, Cogn., from China, has been cult. abroad: lvs. broadly ovate-cordate, more or less angular, 4–5 in. long: staminate fls. 3–6 at the apex of a 3–5-in. peduncle, with large golden-yellow petals; pistillate fls. solitary or in pairs, short-stalked, slightly smaller than the staminate: fr. about 2½ in. long, densely hairy and greenish, 7–8-ribbed. *H. caudigerum*, Wall., the other species, has very lightly crenulate ovate lvs. to 6 in. long: staminate fls. usually on twin peduncles, one single-fld. and one 5–10-fld.; pistillate fls. on stout peduncles less than 1 in. long: fr. sparsely hairy, about 3 in. long. L. H. B.

HESPERALÒE (Latin, *western Aloe*). *Liliàceæ*, tribe *Yúcceæ*. Acaulescent plants with filiferous leaves like many yuccas, but ephemeral diurnal greenish or red flowers, recalling those of the true aloes. Cultivated somewhat in the open in warm dry regions, but elsewhere under glass. Treatment much as for agaves.

Leaves outcurved, soft-pointed, with coarse marginal threads: infl. usually few-branched; fls. oblong; filaments slender, attached to base of perianth; pistil with ovoid ovary, slender style and small stigma: caps. 3-celled, 6-valved, rugose, beaked; seeds thin, flat and smooth.—Two species from Texas to Mex.

parviflòra, Coult. (*H. yuccæfòlia*, Engelm. *Alòe yuccæfòlia*, Gray. *Yúcca parviflòra*, Torr. *Y. parvifòlia*, Hemsl.). Cespitose: lvs. concave, striate on back, 1 in. x 3–4 ft., green: infl. 3–4 ft. high, glabrous and somewhat glaucous; fls. nodding, rosy, 1¼ in. long; style exserted: caps. round, 1 in. long. S. W. Texas. Rep. Mo. Bot. Gard. 13:1, 85.—With more bell-shaped fls. 1 in. long, and scarcely protruding style it is var. **Engelmannii**, Trel. (*H. Engelmannii*, Krauskopf). G.C. II. 18:199. B.M. 7723. Rep. Mo. Bot. Gard. 13:1.

funifera, Trel. (*H. Dàvyi*, Baker. *Yúcca funífera*, Koch. *Agàve funífera*, Lem.). Larger: infl. 6–8 ft. high; fls. purplish green, 1 in. long; style scarcely protruding: caps. 1–2 in. long. N. Mex.—The source of Zamandoque fiber, one of the kinds of "Tampico hemp." WILLIAM TRELEASE.

HESPERÁNTHA (Greek, *evening flower*). *Iridàceæ*. Bulbs, sometimes grown indoors.

These plants belong to the Ixia tribe and are much inferior to ixias for general cult., but have fragrant fls., opening at evening; the style is short with long subulate branches, and the spathe-valves are green rather than brown. The genus is still more closely allied to Geissorhiza, and differs in having shorter style and longer style-branches and spathe-valves always green instead of sometimes brownish above. The corms are ½in. thick or less: lvs. 2–5, narrow and distichous: fls. 2–10 in a lax, distichous spike; perianth rotate and a cylindrical tube; inner segms. white; outer ones red outside; stamens inserted on the throat.—Species about 40, in Trop. Afr. and the Cape, mostly the latter. For cult. see *Ixia* and *Bulbs*.

A. *Foliage hairy.*

pilòsa, Ker. Corm globose: lvs. 2, linear, erect, strongly ribbed, 3–6 in. long: st. slender, erect, 6–12 in.: outer segms. claret-red or green. B.M. 1475 (outer segms. speckled with color).

AA. *Foliage not hairy.*

falcàta, Ker. Corm conic: lvs. 2–4, lanceolate, spreading, 2–3 in. long: st. slender, 1 ft. or less, simple or forked: outer segms. claret-red. B.M. 566 (as *Ixia falcata*).

graminifòlia, Sweet. Corm globose: lvs. 3–5, linear, erect, 4–6 in. long: st. slender, 1 ft. or less, simple or rarely forked: outer segms. reddish brown or reddish green outside. B.M. 1255 (as *Geissorhiza setacea*). L. H. B.

HESPERETHÙSA (from Latin *Hesperethusa*, one of the Hesperides). *Rutàceæ*, tribe *Citreæ*. A slender, spiny tree or shrub: lvs. persistent, pinnate: fls. 4-merous; stamens 8, free: frs. small, 4-celled, a single seed in each cell but with no pulp-vesicles; seeds hard and rounded, cotyledons epigeous in germination: the first foliage-lvs. simple, opposite.—Only 1 species is now recognized.

crenulàta, Roem. (*Limònia crenulàta*, Roxbg. *L. acidíssima*, Auct., not Linn.) NAIBEL. Fig. 1825. Lvs. 5–9-foliate, the lfts., winged petiole and broadly winged segms. of the rachis crenate-margined: fls. small, white, fragrant, 4-merous; ovary 4-celled, 1 ovule in each cell: frs. small (⅛–½in. diam.), globose, dark-colored when ripe, containing 1–4 hard smooth seeds imbedded in a scanty very bitter pulp which is not composed of pulp-vesicles: cotyledons epigeous in germination, remaining small, caducous: first foliage-lvs. simple, opposite, ovate, crenate-margined. Ill. Roxbg. Pl. Corom. 1:60, pl. 86. Talbot, For. fl. Bombay, p. 198, fig. 121.—This plant is usually but erroneously called *Limonia acidissima*, Linn., which name was originally applied to the wood-apple, *Feronia Limonia*, Swingle, which see. The genus Limonia is invalid and hence the oldest valid name for this plant is the one used here. A handsome spiny shrub or small tree with beautiful light green foliage, native to dry hills in Ceylon, India, Burma and Indochina. It is easily grown under greenhouse conditions and should be better known as an ornamental. The frs. are sometimes used as a condiment in India and Arabia; they are bitter, not sour. The tree has a vigorous root-system and is deserving of trial as a stock on which to graft citrous fruit trees. In the greenhouses of the Dept. of Agric. at Washington, D. C., it has been found to grow readily when grafted on grapefruit (*Citrus grandis*), lemon (*Citrus Limonia*) and on the tabog (*Chætospermum glutinosa*) and it is probable that it could be used as a stock for these and other species. WALTER T. SWINGLE.

1825. Hesperethusa crenulata. (×⅕, fruit ×¾)

HÉSPERIS (Greek, *evening*, same root as vesper; flowers more fragrant at evening). *Cruciferæ*. This includes the dame's rocket, a vigorous old-fashioned hardy herbaceous perennial.

Herbs, biennial or with a st. that is perennial at the base, pilose, the hairs simple, forked or glandular: st.-lvs. usually sparse, ovate or oblong, entire, dentate or lyrate: fls. white or purple, in loose racemes, often fragrant; petals 4, long-clawed; stigma lobed and erect: pods long, linear, cylindrical or nearly so; seeds in 1 row in each cell, usually wingless. The genus is allied to the stocks, but has a somewhat different habit and the cotyledons incumbent not accumbent.—Species about 2 dozen in the Medit. region to Cent. Asia.

1826. Dame's Rocket or sweet rocket—Hesperis matronalis. (×½)

matronàlis, Linn. ROCKET. SWEET ROCKET. DAME'S VIOLET. DAMASK VIOLET. Fig. 1826. Lvs. ovate-lanceolate, 2–3 in. long, toothed: pods 2–4 in. long, straight, much contracted between the seeds. Eu., N. Asia. Escaped from gardens. Gn. 53, p. 293; 49, p. 339 (a lovely garden view).—Forms clumps 2–3 ft. high, branched from the base, and covered with showy terminal pyramidal spikes of 4-petaled fls. resembling stocks. The colors range from white through lilac and pink to purple. The double forms are most popular. The plant blooms from June to Aug., and has long been cult. in cottage gardens. The ordinary single forms are not worth growing in the border, but may be used in wild gardens. The double rockets are amongst the best hardy plants, very productive of bloom and useful for cutting. The double-fld. white, var. **álba-plèna,** Hort., very fragrant, is much prized. G. 25:283; 28:701. Gn. W. 22. suppl. Apr. 29. Var. **purpûrea,** Hort., is a purple-fld. garden form. Var. **pùmila,** Hort., is a dwarf form. Var. **nàna candidíssima,** Hort., is a pure white garden form. WILHELM MILLER. L. H. B.†

HESPEROCÁLLIS (Greek, *evening beauty*). *Liliaceæ*. Leafy stemmed bulbous plant of the Colorado desert, and the desert sections of southern California, sometimes planted in California and elsewhere.

Of the tribe Hemerocallideæ, and characterized by Watson as having a large white perianth cleft to below the middle, the segms. several-nerved: anthers linear: caps. ovate-oblong, deeply lobed: fls. few in a raceme, the stout pedicels jointed at the top; seeds many, horizontal, flattened, black.—One species.

undulàta, Gray. Bulb large, corm-like: st. stout, 1–2 ft. high, 5–8-fld.: lvs. linear, fleshy, keeled, 3–6 lines wide, wavy margined: fls. 1½–2 in. long; style exserted: caps. ½in. long.—The fls. very fragrant, waxy-white or greenish; bulb should be deeply planted. L. H. B.

HESPEROCHÌRON (Greek, *hesperos*, originally evening, but here western, i.e., in the direction of the setting sun, and *Chiron*, a centaur distinguished for his knowledge of plants; hence "Western Centaury," these plants being at first placed in the Gentian family). *Hydrophyllàceæ*. Northwest American tufted perennial herbs with scapes bearing solitary, rather large whitish flowers, ¾ inch or less long. The nearest allied genera of recognized garden value are Phacelia and Emmenanthe, which are very distinct in color of flowers, general appearance and cymose inflorescence.

Dwarf, stemless perennials or possibly biennials: peduncles all radical and 1-fld.: lvs. entire, spatulate or oblong: fls. purplish or nearly white, with parts normally in 5's rarely in 6's to 7's; style 2-cut: caps. 1-celled, loculicidal, 15–20-seeded; seeds minutely netted or wrinkled.—Two species that have been procurable through Californian specialists and collectors.

A. *Corolla-lobes shorter than the tube.*

califórnicus, Wats. (*Capnòrea nàna*, Raf.). Lvs. numerous in a radical tuft: corolla somewhat oblong bell-shaped. Hills and meadows, Utah to Wash. and Calif. *H. latifòlius*, Kellogg, is a large form. B.R. 833 (as *Nicotiana nana*).

AA. *Corolla-lobes longer than the tube.*

pûmilus, Porter (*Capnòrea pùmila*, Greene). Lvs. fewer: corolla nearly wheel-shaped; tube densely bearded within. Springy and marshy grounds in mountains, Idaho and E. Wash. to Calif.

WILHELM MILLER.

HESPEROSCÓRDUM: *Brodiæa.*

HESPEROYÚCCA (Latin, *western yucca*). *Liliàceæ*, tribe *Yúcceæ*. Yucca-like nearly acaulescent plants, forming a very characteristic feature of the coast-range flora of California when in bloom. Hardy only in mild regions: frequently planted out-of-doors like yuccas in California, but elsewhere requiring house protection. Cultivated much like agaves.

Leaves narrow, rigid, pungently pointed, rough-edged: infl. panicled; fls. vespertine, cup-shaped as in Yucca, usually white; filaments clavate, attached to base of perianth; pistil with short oblong ovary, abrupt slender style, and fimbriate capitate stigma: caps. incompletely 6-celled, 3-valved through the laciniate false septa; seeds thin, flat and smooth.—Only the following species:

Whípplei, Baker (*Yúcca Whípplei*, Torr. *Y. graminifòlia*, Wood. *Y. Ortgiesiàna*, Roezl. *Y. califórnica*, Groenl.). Simple or cespitose: lvs. more or less 3-sided, finely striate, rough-edged, ½in. x 1–3 ft., glaucous: infl. 6–15 ft. high, oblong, long-peduncled, glabrous; fls. nodding, fragrant: caps. broad, 2 in. long. S. Calif. G.C. II. 6:197. Gn. 35, p. 561. R.H. 1886, p. 63. B.M. 7662 Rep. Mo. Bot. Gard. 3:11, 12, 54; 4:17, 23; 13:4, 5, 85.—With extremely glaucous lvs. it is var. **glaûca,** Hort. With decidedly violet-shaded fls. it is var. **violàcea** (*Y. Whípplei violàcea*, André). R.H. 1884:324. G.C. III. 39:154; 51:106 and suppl. With flatter, broader and smoother-edged lvs. it is var. **nítida** (*Y. nítida*, Wright). G.C. III. 39:153. G. 30:33. Gn. 69, p. 161. WILLIAM TRELEASE.

HETERANTHÈRA (name refers to the unlike or different anthers). *Pontederiàceæ*. A few American bog herbs, one of which now and then occurs in horticultural literature. Sts. creeping, ascending or floating: lvs. long-stalked, grass-like or the blades ovate, oval or reniform: fls. white, blue or yellow, small, arising from the sheathing base of the petiole; perianth with slender tube, the segms. narrow and nearly or quite equal; stamens 3, unequal or equal: fr. a 1-celled or 3-celled caps. inclosed in the withered perianth-tube. *H. limòsa*, Willd., has blue fls.: spathe 1-fld.: lvs. oblong to lance-

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oblong, obtuse. *H. renifórmis*, R. &. P., has smaller white or pale blue fls.: spathe 3–5-fid.: lvs. orbicular-reniform to cordate, acute. Both these species have unequal anthers. *H. dùbia*, MacM., has equal anthers and small pale yellow fls. All these are natives in E. U. S. and southward, and are useful for transferring to wet grounds and shallow pools. L. H. B.

HETEROCÉNTRON (*unlike spurs*, referring to structure of anthers). *Melastomàceæ*. Includes *Heeria* of Schlechtendal, not of Meissner. About 6 Mexican and Central American species, sometimes grown under glass.

Herbs or shrubs, erect or prostrate, with opposite membranaceous pinnately nerved (rarely 3-nerved) entire lvs., and white, rose or purple irregular fls. in panicles or rarely solitary: stamens 8, very unequal, the 4 larger ones with long appendages or connections; ovary loculed; petals 4.—Not to be confounded with Centradenia, which has winged sts. unequal-sided lvs., and calyx-teeth small and much shorter than the calyx-tube.—Warmhouse plants, requiring the cult. of centradenia, but grown chiefly for the fls., whereas centradenias are grown also for foliage.

rôseum, A. Br. (*H. mexicànum*, Naudin. *Heèria rôsea*, Triana) is the only species in general cult.: 1 ft. or more high, with 4-angled (but not winged) st.: lvs. elliptic, obtuse or acute, pinnate-nerved: fls. bright rose, in a large, terminal panicle, showy, in autumn and early winter. B.M. 5166. I.H. 3:97. Var. **álba**, Hook., is a white-fld. form.

subtriplinérvium, A. Br. (*Heèria subtriplinérvia*, Triana). Little branched, the branches sharply 4-angled, the young foliage and calyx sparsely pilose: lvs. oblong-lanceolate, acute at apex, narrowed into long petiole, the margin entire, blade 9–13-nerved: fls. white, the petals broadly obovate with retuse apex. Mex.

H. élegans, O. Kuntze (Heeria elegans, Schlecht. H. procumbens, Naudin), will be found under Schizocentron. L. H. B.

HETERÓMELES: *Photinia*.

HETEROPÁPPUS (Greek, *two kinds of pappus*). *Compósitæ*. A hardy herbaceous perennial that bears azure-blue aster-like flowers in summer.

Herbs, erect, branched above: lvs. alternate, entire or coarsely toothed: heads in loose irregular panicles or solitary at the tips of branches, rays white or sky-blue. The genus is closely related to Aster, having the habit of the asters of the section Calimeris. The plant in the trade is known as *Calimeris tatarica*. Heteropappus is closely related to Boltonia and is not far from Callistephus, which contains the China asters. The chief botanical distinction resides in the pappus, which in the large group containing Callistephus and Aster is composed of numerous bristles arranged in one or more series, while Boltonia and Heteropappus belong to a group in which the pappus is anomalous. In Boltonia it is composed of very short, somewhat chaffy bristles, with the addition usually of 2–4 awns not longer than the achene. In Heteropappus the pappus of the rays is composed of very short, somewhat chaffy bristles, while in the disk-fls. it consists of numerous slender bristles arranged in 1 or 2 series.—A genus of 2–4 species from Japan and China.

hìspidus, Less. (*Calimeris tatárica*, Lindl. *Áster hìspidus*, Thunb.). St. roughish: lvs. linear, acute, pubescent and ciliated on the margins: branches spreading, usually unbranched and bearing 1 head: involucral scales acuminate, hirsute, herbaceous, not white-margined, rays blue. Japan, Mongolia. L. H. B.

HETEROPHRÁGMA (Greek, *different* and *septum*; alluding to the peculiar 4-angled septum of the typical species). *Bignoniàceæ*. Three species of E. Indian trees, with large opposite pinnate lvs. and large yellow or pink fls. in terminal panicles or from the old wood: calyx campanulate, irregularly 3–5-lobed; corolla campanulate-funnelform; ovules in several series in each cell of the broadly linear ovary: caps. cylindric or compressed, falcate or twisted, loculicidally 2-valved; septum flat or 4-angled. The 2 African species referred by some writers to this genus belong to Fernandia. Only the following species has been offered in this country. **H. adenophýllum**, Seem. (*Bignònia adenophýlla*, Wall.). Tree, 30–50 ft.: young growth tomentose: lfts. 5–7, broadly elliptic, acute or obtuse, entire, tomentose, 7–9 in. long: fls. in terminal panicles; calyx irregularly 5-lobed; corolla brownish yellow, densely woolly outside, with spreading 5-lobed limb, 2 in. wide: caps. twisted, resembling a cork-screw, 1–3 ft. long; septum flat. Wight, Ill. 160 (as *Spathodea adenophylla*). —Little known in cult. and adapted for subtropical or tropical countries only. Prop. probably like Radermachia by cuttings and air-layering.

ALFRED REHDER.

HETERÓPTERIS (*various winged*, referring to the fr.). *Malpighiàceæ*. Shrubs, erect or rarely climbing, of Trop. Amer. and 1 in W. Afr. Fls. small, yellow or purple, in panicles or racemes: lvs. opposite, nearly or quite entire. The calyx is 5-parted, some or all the lobes with a pair of sessile glands; petals clawed; stamens 10, all perfect but unequal; ovary 3-celled, with 3 subulate styles, the stigma on an angle of the style: fr. 1–3 samaras, with a somewhat semi-circular wing.—Species 90 or more. The climbing species may be found in choice collections. *H. purpùrea*, Kunth, is a low climber among shrubs, according to Grisebach, in the farther W. Indies and Venezuela: lvs. oval, glabrous, somewhat glaucous beneath, the petiole with 2 glands at the middle: fls. purple, corymbose or racemose, on slender pedicels that are jointed below the middle: fr. 1 in. long, with semi-obovate oblique wings. *H. chrysophýlla*, HBK. Twining: lvs. oval or oval-oblong, entire, glabrous above and golden pubescent beneath: fls. orange, becoming reddish. Brazil. B.M. 3237. An interesting plant for the warmhouse, long-climbing.

L. H. B.

HETEROSMÌLAX (Greek, *another kind of Smilax*). *Liliàceæ*. This includes an ornamental climber with the habit of smilax, but the perianth is undivided (instead of 6-parted, as in smilax) and the mouth is minutely 2–5-dentate. It resembles smilax in having dicœcious fls. borne in umbels, and tendril-bearing petioles. The genus contains 5 species of woody climbers from India, Malaya, China and Japan: lvs. 3–5-nerved: fls. small or very small. Little known culturally outside the far East.

japónica, Kunth. Lvs. with stalks about ½in. long, blades about 4–5 in. long. Japan, where it is cult. for the roots, which are used in medicine; Hemsley writes that it is said to have been intro. into Japan from China but that no Chinese specimens are known to exist (1903). L. H. B.

HETEROSPÀTHE (Greek, a *different kind of spathe*). Also written *Heterospatha*. *Palmàceæ*, tribe *Arèceæ*. A rare and highly ornamental palm, with graceful, spreading habit and pinnatisect leaves, the segments being long, slender and tapering.

Its nearest allies of garden value are Verschaffeltia and Dypsis, in which the stigmas are basal in fr., while Heterospatha belongs to a group in which the stigmas are eccentric or lateral in fr. Other important generic characters are the 6 stamens with versatile anthers and the 1-celled ovary.—Only 1 species, native of the small island of Amboyna, the Dutch headquarters in the E. Indies. Intro. from the Java botanic garden in 1879 to England. The plant is procurable from importers and from S. Fla., but is cult. in Amer. only in botanic gardens.

LIV. Herbs and shrubs employed about a pond.

elàta, Scheff. (*Metróxylon elàtum,* Hort.). Tall, unarmed: lvs. terminal, long-petioled, equally pinnatisect; segms. numerous, lanceolate, narrowed at both ends, acuminate, 1-nerved, margins thickened and recurved at the base; rachis round on the back, flat on the face; sheath short, fibrous, swelled at the base: spathes 2, the lower 2-crested, the upper much longer.—A very worthy palm, valuable chiefly for its graceful habit while still quite young. Must be grown in a moist hot house. N. TAYLOR.†

HETERÓTOMA (name refers to the unequally cut corolla). *Campanulàceæ.* About 10 species of Mexican annuals and perennials, one of which has come somewhat into cult. Lvs. alternate: fls. blue, yellow or orange, in terminal racemes; calyx tubular with an unequally 5-parted limb, the 2 anterior lobes usually adnate to the spur of the corolla; corolla-tube split to the base on the back, in front produced into a horizontal or deflexed spur, the limb short and incurved and with either nearly equal or unequal lobes; stamen-tube free from corolla; ovary inferior, 2-celled, many-ovuled: caps. 2-valved. **H. lobelioìdes,** Zucc. Erect, branching, the st. pubescent: lvs. alternate, ovate-lanceolate, distantly toothed, acuminate: fls. about 2 in. long, single on slender axillary peduncles, odd; corolla-spur blood-red, the limb golden yellow and 3-lobed; lower lip of calyx adnate to the corolla-tube and the 2 subulate green lobes projecting beyond it; staminal column erect, as long as the corolla-limb, and prominent. Mountains in Mex. and Cent. Amer. B.M. 7849. R.H. 1905, p. 9.—An interesting showy perennial, sometimes called "bird flower," to be grown in a cool greenhouse in winter and in the open in summer.

L. H. B.

HETERÓTRICHUM (name refers to the *variable hairs* on the lvs.). *Melastomàceæ.* Ten or a dozen hispid, or glandular shrubs in Trop. Amer., with white or pink fls. in terminal or lateral panicles; calyx campanulate or globular, with 4–8 teeth; corolla of 6–8 petals; stamens 8–12 or more: lvs. large, ovate or oblong, cordate at base, entire or toothed. *H. màcrodon,* Planch., is sometimes mentioned in horticultural literature. A very handsome shrub, 7–9 ft., flowering when small: lvs. opposite, large, the 2 in the pair unequal, cordate-ovate, abruptly acuminate, serrate, 7-nerved: fls. 10–12 in a terminal cyme, white with red at base of petals, 1¾ in. across, the 8 petals obovate and flat-spreading; calyx and young parts hispid or villous. Venezuela. B.M. 4421. G.W. 14, p. 652.—Requires hothouse treatment.

L. H. B.

HEÙCHERA (Johann Heinrich von Heucher, 1677–1747, professor of botany at Wittenberg). *Saxifragàceæ.* Herbs resembling the dainty wild flower, the bishop's cap (Mitella) in their habit, as they have a tuft of heart-shaped, five- to nine-lobed, crenate leaves, from which spring a dozen or so slender scapes a foot or more high with small flowers borne in panicles, giving a delicate and airy effect. This includes *H. sanguinea* which probably ranks among the best low perennials with small, red flowers. It is very desirable for the hardy border, where it blooms from spring to late fall. It is also useful to florists for cut-flowers and autumn forcing.

Heuchera belongs to a group of genera including Mitella and Tiarella, in which the ovary is 1-celled. There is a well-developed hypanthium often bell-shaped, sometimes urceolate, cylindrical, turbinate, or saucer-shaped, often more or less oblique, and adnate to the lower part of the pistil. Most of the distinguishing characters of this difficult genus are found in the shape of the hypanthium. In Heuchera the petals are 5 or none, and entire; in Mitella 5, 3-fid or pinnatifid; in Tiarella 5 and entire. Heuchera has 5 stamens; Mitella 5 or 10; Tiarella 10. The caps. of Heuchera is inferior, 2-beaked; in Mitella superior, not beaked; in Tiarella superior, compressed.—Heuchera has 72 species, all N. American and ranging from Mex. to the arctic regions. A full botanical treatment is by P. A. Rydberg, in N. Amer. Flora. 22:97–117 (1905), which has been followed in the account below. Many of the species are distinguished only by rather technical botanical characters, but only a few of them are known horticulturally.

The attractive and petal-like part of *H. sanguinea* is the calyx, the petals being small in all heucheras (often shorter than the calyx). The other species are attractive by reason of their general habit, and particularly the graceful, open panicle. *H. sanguinea* came into prominence about 1884 and is now deservedly one of the most popular of hardy perennials. The others are procurable from the largest dealers in native plants and from western collectors. They range from 3 inches to 3 feet high, averaging about 1½ feet, and bloom in summer, having greenish white or purplish flowers. Almost any good garden soil suits them, and they are not particular as regards exposure to sunlight (though an open situation is preferable); and they look well in borders, rockeries, separate beds and elsewhere. Propagate by division or seed.

INDEX.

alba, 10.
americana, 3.
bracteata, 7.
brizoides, 10.
cylindrica, 9.
erubescens, 2.
gracillima, 10.
grandiflora, 10.
hispida, 6.
hybrida, 10.
maxima, 10.
micrantha, 2.
parvifolia, 8.
pubescens, 5.
ribifolia, 5.
robusta, 10.
rosea, 10.
rubescens, 4.
rubifolia, 5.
sanguinea, 10.
splendens, 10.
villosa, 1.

KEY TO THE SPECIES.

A. *Stamens equaling or exceeding the sepals.*
  B. *Panicle open, not spike-like.*
    C. *Hypanthium not strongly oblique.*
      D. *Breadth of hypanthium about as the length.*
        E. *Lobes of the lf.-blade broadly triangular, acute* ..... 1. **villosa**
        EE. *Lobes of the basal lf.-blades, at least, rounded.*
          F. *The hypanthium, with the sepals 1–1½ lines long* ... 2. **micrantha**
          FF. *The hypanthium, with the sepals 1½–4 lines long* .. 3. **americana**
      DD. *Breadth of hypanthium about twice the length* ..... 4. **rubescens**
    CC. *Hypanthium strongly oblique; stamens equaling or slightly exceeding the sepals.*
      D. *Flowering branches more or less leafy* ..... 5. **pubescens**
      DD. *Flowering branches leafless or practically so* ..... 6. **hispida**
  BB. *Panicle dense, contracted, almost spike-like* ..... 7. **bracteata**
AA. *Stamens much shorter than the sepals.*
  B. *Hypanthium and sepals 1½–2½ lines long* ..... 8. **parvifolia**
  BB. *Hypanthium and sepals 2½–5 lines long.*
    C. *Infl. contracted and spike-like* ..... 9. **cylindrica**
    CC. *Infl. open, not spike-like* ..... 10. **sanguinea**

1. **villòsa,** Michx. Height 1–3 ft.: lf.-blades nearly round, deeply 5–7-lobed, the lobes triangular acute: scape mostly leafless; calyx and hypanthium about 1 line long; petals pinkish, twice as long as the sepals. Rocky places, Va. to Ga. and Tenn. B.B. 2:179.—A good border plant.

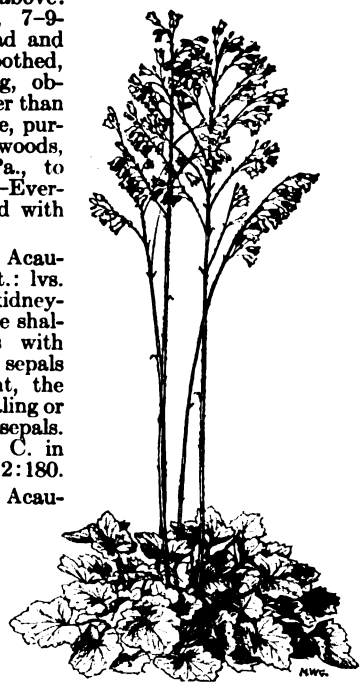
2. **micrántha,** Douglas. Height 1–2 ft., the flowering branches 1–4-lvd. or almost scape-like.: lvs. slightly hairy, the blades round-cordate, about as long as broad, long-stalked: infl. glandular-hairy; petals oblanceolate, whitish, not very showy. Calif. to Brit. Col. B. R.

1302. R.H. 1898, p. 431.—The *H. erubescens* of the gardeners seems certainly to belong here.

3. **americàna,** Linn. ALUM ROOT. Height 2–3 ft.: scape leafless or with a few small lvs.: basal lvs. round-cordate, hirsute on the veins beneath, often glabrous above, at least when mature: infl. glandular hairy; the petals about equaling the sepals, greenish white; stamens at least 3 times the length of the sepals. Dry or rocky woods, Ont. to La. and Minn. B.B. 2:179. R.H. 1898, p. 431.—Has mottled foliage when young, but becomes plain green in age.

4. **rubéscens,** Torr. Acaulescent: height 8–15 in.: scape usually leafless: lvs. kidney-shaped or round-cordate, perfectly glabrous or sometimes slightly glandular, thick and often shining: sepals pinkish, green-tipped; petals almost twice as long as the sepals, linear-oblanceolate. Mountains of Utah and New Mex. to Ore and E. Calif.—Useful for the alpine-garden.

5. **pubéscens,** Pursh (*H. ribifòlia*, Fisch. & Avé-Lall. *H. rubifòlia*, Hort., also seems to belong here). Acaulescent: height 9–12 or 15 in.: scapes densely glandular pubescent, at least above: lvs. round-cordate, 7–9-lobed, the lobes broad and rounded, sharp-toothed, ciliate; sepals oblong, obtuse, somewhat shorter than the broadly spatulate, purplish petals. Rich woods, in mountains of Pa., to N. C. B. B. 2:179.—Evergreen foliage marbled with bronzy red.



1827. Heuchera sanguinea.

6. **híspida,** Pursh. Acaulescent: height 2–4 ft.: lvs. round-cordate or kidney-shaped, 5–9-lobed, the shallow, rounded lobes with broad teeth, ciliate: sepals spatulate, very blunt, the petals spatulate, equaling or shorter than the sepals. Woods, Va. and N. C. in the mountains. B.B. 2:180.

7. **bracteàta,** Ser. Acaulescent and densely cespitose: flowering branches usually about 4–6 in. tall, usually with a few minute lvs.: basal lvs. round-kidney-shaped, more or less round-lobed and with cuspidate teeth: sepals oblong, obtuse, the petals oblanceolate or spatulate, slightly exceeding the sepals. Alpine regions of Colo. and S. Wyo.—Useful only in alpine collections.

8. **parvifòlia,** Nutt. Acaulescent and cespitose: flowering branches scape-like and quite naked: lvs. kidney-shaped, usually with an open sinus, and with 7–9 shallow, rounded lobes: infl. ultimately elongated; sepals broadly ovate, somewhat shorter than the spatulate, yellowish petals. Alberta to N. Mex. and Ariz.

9. **cylíndrica,** Douglas. Acaulescent: height 10–24 in.: the infl. spike-like and naked or with a few minute bracts: lvs. round-cordate, with a few shallow lobes and ovate, cuspidate teeth; sepals oblong, the yellowish green petals minute or sometimes lacking. Brit. Col. to Ore. and Idaho.—Grown chiefly for its foliage.

10. **sanguínea,** Engelm. CORAL BELLS. CRIMSON BELLS. Fig. 1827. Height 1–1½ ft.: scapes pilose below, glandular pubescent above: fls. typically bright red, but in horticultural varieties ranging from white through pink and rose to dark crimson. New Mex., Ariz. and N. Mex. Very good pictures are B.M. 6929. Gn. 26:360; also those in Gt. 45, p. 577. I.H. 43, p. 334. Mn. 8 p. 75. A.G. 17:201. R.H. 1898, p. 431. R.B. 22, p. 246. S.H. 2:120. G.C. III. 4:125. P.G. 4:35. Var. **álba** (*H. álba*, Hort.) has pure white fls., and was intro. about 1896 by Haage & Schmidt. Var. **spléndens,** intro. 1898 by the same firm, has dark crimson fls. Var. **robústa,** or **grandiflòra,** Hort., according to J. B. Keller, is an improvement on the type, the bells being larger and the color brighter. Var. **hýbrida** ("Rosy Morn"), Hort., according to D. M. Andrews, is "more robust than the type, foliage deeper cut and the divisions more pointed: fls. rosy pink." Andrews adds that var. **álba** comes true from seed. Var. **ròsea,** and var. **máxima** with dark crimson fls. are advertised. —Under the name *H. brizoides*, Hort., there is a widely cult. plant with red sts. and pale pink fls. It is chiefly interesting because it is a bigeneric hybrid, it apparently being a cross between *Heuchera sanguinea* and *Tiarella macrophylla*. It is a garden hybrid first noticed in 1897. Var. **gracíllima,** Hort., seems merely a more slender form.

The following names are seen in trade catalogues or in Rydberg's monograph: *H. convallària*, Hort. About 2½ ft., with long-stalked panicles of fls. somewhat like the lily-of-the-valley. There is a pink-fld. form, *H. cárnea.*=(?)—*H. cristàta* has been listed in Calif. as "a wonderfully pretty crested variety, originated by Luther Burbank."—*H. macrophýlla*, Hort., not Lodd., may be Tiarella macrophylla.—*H. pilosissima*, F. Muell. 1–2 ft. high: fls. in close clusters; calyx globular. Calif.—*H. purpurascens* was advertised 1898.—*H. Wheeleri*, Hort., was found in the S. some years ago, and resembles a form of H. canadensis with variegated lvs.—*H. Zabelliàna*, Hort., has pale pink fls. on long fl.-stalks.

N. TAYLOR.†

HEÚRNIA: *Huernia.*

HÈVEA (from the Brazilian name). *Euphorbiàceæ.* Tropical trees; some yield rubber and are cultivated for that reason.

Juice milky: lvs. alternate, long-petioled, the 3 lfts. entire: fls. small, monœcious, in loose panicles; calyx valvate, 5-lobed or 5-toothed; petals none; stamens 5–10, filaments united into a column; ovary 3-celled, 1 ovule in each cell: fr. a large caps.; seeds about 1 in. long.—About 17 species chiefly in the Amazon region.

The milky juice of some species is rich in caoutchouc, and they are among the most important sources of rubber; otherwise rarely cultivated except in economic and botanical collections. *H. braziliensis*, especially var. *janeirensis*, Pax, is the chief source of the South American or Para rubber. The various species are closely related and difficult to separate. The rubber plant commonly cultivated as a house-plant is *Ficus elastica.*

Damp, hot climates, such as the tropical rain forest region, without a dry season, are best suited for the culture of hevea, though it will stand some drought. It is best grown from seeds, but can be propagated by cuttings. The seed should be planted as soon as ripe, as they live but a short time. The trees grow rapidly, and attain their full height of 60 feet in about eight years, but live for many years longer. A six-year-old tree will yield as much as a pound of rubber a year and more when older. For further directions on culture, see "Cyclopedia of American Agriculture," Vol. II, p. 555. See M. T. Cook, "Diseases of Tropical Plants, p. 191, for rubber plant diseases.

brasiliénsis, Muell. Arg. SOUTH AMERICAN RUBBER TREE. PARA RUBBER TREE. CAOUTCHOUC TREE. BRAZIL RUBBER. SERINGUEIRA. Tree, to 60 ft. high: petioles slender, 3–10 in. long; lfts. elliptical-lanceolate, 6 in. long, straight-veined: branches of the panicle and fls. finely and closely pubescent: staminate buds acute; stamens 10 in 2 whorls. Amazon region of Brazil. Quite variable. H.I. 2573, 2575. Gn. 18, p. 564.

paucifòlia, Muell. Arg. (*H. confùsa*, Hemsl.). Tree, to 60 ft. high: lfts. obovate, cuneate, obtuse acuminate, 4–6 in. long: staminate buds obtuse; stamens 10 in 2

whorls. British Guiana. H.I. 2574, 2575.—Sometimes used for rubber.

guianénsis, Aubl. (*Siphònia Cahùchu*, Willd. *S. elástica*, Pers.). SERINGA. Tree, to 60 ft. high: lfts. obovate, base acute, apex obtuse, 3–5 in. long: panicle tomentose: staminate buds obtuse; stamens 5 in 1 whorl. French Guiana to the Amazon. H.I. 2573.—Intro. but rarely cult. for rubber. J. B. S. NORTON.

HEXACÉNTRIS: *Thunbergia.*

HEXADÉSMIA (name alludes to the 6 pollen-masses). *Orchidàceæ.* About a half-dozen Trop. American epiphytic orchids, rarely grown in hothouses. They are like Scaphyglottis, but differ in having 6 pollinia in 2 series rather than 4. The fls. are small, in fascicles or racemes: lvs. fleshy. Apparently none of the species is in the trade.

HEXASTÝLIS: *Asarum.*

HEXÍSEA (Greek, *six equal things;* because the attractive and bright-colored parts of the fls. are 6, and of equal size.) Should have been written *Hexisia. Orchidàceæ.* This includes a small epiphytic plant which was once advertised as "bearing profuse panicles of bright vermilion fls. twice a year." The genus belongs to a subtribe closely related to Epidendrum but with different pollinia. Sts. terete or angled, with usually 2 lvs. at the apex of each annual growth. New growths arise in the axils of the lvs., the entire st. being thus made up of long, fusiform, apparently superimposed pseudobulbs, with 2 lvs. at each node: lvs. few, narrow: racemes terminal, the short-peduncled furnished with overlapping, leathery scales; fls. orange or purple; anthers semi-globose; pollinia 4, in 1 series.—Four species, ranging from Mex. to Guiana.

bidentàta, Lindl. Height 6–8 in.: st. branched, forming spindle-shaped, many-grooved internodes: lvs. in pairs, 2–4 in. long, 3 lines wide, channelled, notched. Panama. B.M. 7031. G.M. 37:19.

HEINRICH HASSELBRING.

HEYDÈRIA: *Libocedrus.*

HIBBÉRTIA (George Hibbert, English patron of botany, died 1838). *Dilleniàceæ.* Shrubs or subshrubs with yellow or white showy flowers, suitable for the greenhouse or for growing in the open in the warm parts; apparently none is in the American trade.

Erect, procumbent or climbing, sometimes almost herbaceous, some species reaching 5 or 6 ft.: lvs. mostly small, entire or dentate, often heath-like, strongly 1-nerved with obscure or rarely prominent reticulations, some of them usually crowded beneath the blossoms: fls. solitary, terminal, sometimes approximating into clusters; sepals 5, sometimes united at base; petals 5, spreading and usually making an open fl.; stamens usually 12 or more, sometimes with staminodia: carpels usually 2–5, dehiscent at the top when ripe.—Species about 100, nearly all Australian, a few from Madagascar. Any of these species is likely to appear in lists, but only 2 or 3 are regularly known as horticultural subjects.

dentàta, R. Br. Woody only at base, trailing or twining, with rather large dark yellow pedunculate fls. (to 2 in. diam.): lvs. stalked, oblong, to 2 in., distantly toothed or sinuate, coppery: petals obovate, entire or nearly so; stamens slender and very numerous; staminodia present. New S. Wales and Victoria. B.M. 2338. B.R. 282. G. 32:127. L.B.C. 4:347.

perfoliàta, Hueg. Sts. trailing, procumbent, ascending or becoming erect: lvs. ovate, usually somewhat toothed, perfoliate: petals obovate, entire, pale yellow, the fls. peduncled; stamens numerous, with a few staminodia. W. Austral. B.R. 29:64. J.H. III. 43:147.

volùbilis, Andr. Sts. woody, trailing, or climbing 2–4 ft.: lvs. obovate to lanceolate, to 3 in., clasping: fls. large, yellow, somewhat fetid, sessile or nearly so; petals obovate, entire; stamens very numerous, no staminodia. Queensland and New S. Wales. B.M. 449.—This and *H. dentata* are offered in England.

L. H. B.

HIBISCADÉLPHUS (brother of *Hibiscus*). *Malvàceæ.* Under this name, J. F. Rock founds three species of Hawaiian small trees; of two of the species only one individual tree is in existence, while of the third several may still be found on the slopes of Mt. Hualalai, in the forest of Waihau, in North Kona, Hawaii. From Hibiscus the genus differs in the deciduous calyx and other floral characters: fls. 2½ in. or less long, yellowish, magenta, or green: lvs. cordate, unevenly 3–5-pointed or rounded and entire. *H. Giffardiànus,* Rock, is a medium-sized tree with peculiarly shaped deep magenta fls. and cordate-orbicular lvs.; a single tree known in 1913 and in danger of extinction. *H. Wilderiànus,* Rock, is a tree 15–18 ft. high with yellowish fls. and 3-lobed wavy lvs. of orbicular outline; one tree known in 1912 and in a dying condition, one on which the collector was able to find 1 open fl. and a few more or less developed buds. *A. hualalaiénsis,* Rock, has green fls. somewhat reddish inside, and somewhat reniform lvs.; a few trees are still in existence. These rare trees are not in the trade, but they are likely to appear in collections in the tropics if they can be rescued before destruction. See Rock, "Indigenous Trees of the Hawaiian Islands."

L. H. B.

HIBÍSCUS (old Latin name). Including *Abelmóschus* and *Parítium. Malvàceæ.* ROSE-MALLOW. Showy-flowered garden and greenhouse herbs and shrubs; in the tropics some of them are trees.

Hibiscus is a polymorphous genus, allied to Gossypium, Abutilon, Althæa and Malva, the species widely distributed in temperate and tropical countries: herbs or shrubs, or even trees, with lvs. palmately veined or parted: parts of the fl. in 5's; calyx gamosepalous, 5-toothed or 5-cleft, subtended by an involucel of narrow bracteoles; corolla usually campanulate, showy, of 5 distinct petals; stamens united into a 5-toothed column; ovary 5-loculed, bearing 5 styles: fr. a dry, more or less dehiscent caps (Fig. 1828).—Between 150 and 200 species, of which perhaps 20 occur in the U. S. Horticulturally, there are 4 general groups of Hibiscus—the annuals, the perennial border herbs, the hardy shrubs, and the glasshouse shrubs, to which might be added the tree-like species of tropical countries that are often planted along roadsides and about dwellings. The perennial herbaceous species are among the boldest subjects for planting in remote borders or in roomy places, particularly in soil that is damp. These plants, of the *H. Moscheutos* type, are commonly known as marsh-mallows, but this name properly belongs to *Althæa officinalis.*

1828. Capsule of Hibiscus syriacus.

In recent years, improved and valuable hardy forms of the native herbaceous rose-mallows have been introduced. They bloom throughout a long season. (Fig. 1829.) The Meehan Mallow Marvels were introduced in 1905, the first successful cross having been made in 1898. They are stated to be hybrids of *H. coccineus, H. militaris,* and *H. Moscheutos.* They are in pink, shades of red, and white; the flowers often have an eye of different color. The Giant-flowering marsh-mallows of Bobbink & Atkins, now catalogued as *H. Moscheutos* hybrids, were first offered in 1909 at retail and in

1911 to the trade. They are stated to be hybrids of *H. coccineus* and *H. Moscheutos*, the first cross being made in 1905, first plant flowered in 1906. The colors range from white to crimson, sometimes with an eye.

The culture of such a various group as hibiscus cannot be described in detail. In general, the species present no special difficulties. They are strong and profuse growers, and mostly thrive under a variety of conditions.—The herbaceous perennial species are late summer and fall bloomers, with hollyhock-like flowers. They send up new strong shoots or canes each year. Many of them are perfectly hardy in the North, but even these profit by a mulch covering. Others are tender in the North, and the roots should be taken

1829. A garden rose-mallow. White. (×⅙)

up after frost and stored in a dry, warm cellar. Keep them just moist enough to maintain life in them. Many times the roots of these herbaceous species are set in large pots in the spring, and they then make excellent specimens. All the species require a deep rich soil and a good unfailing supply of moisture.—The only popular glasshouse species in this country is *H. Rosa-sinensis*, a showy and floriferous summer bloomer, of many varieties. The culture of this species is indicated under No. 28.

INDEX.

Abelmoschus, 4.
aculeatus, 8.
africanus, 1.
amplissimus, 29.
anemonæflorus, 29.
Arnottianus, 25.
atrorubens, 29.
bicolor, 29.
brilliantissimus, 28.
californicus, 12.
Calleri, 28.
calycinus, 22.
camelliæflorus, 29.
cannabinus, 3.
carminatus, 28.
chrysanthus, 22, 28.
cisplatinus, 17.
coccineus, 10.
cælestis, 29.
Cooperi, 28.
Denisonii, 26.
dissectus, 6.
diversifolius, 7.
elatus, 20.
elegantissimus, 29.
esculentus, 5.
Fauriei, 25.
flore-purpureo, 16.
fulgens, 28.
fulgidus, 28.
Genevii, 24.
grandiflorus, 11.
Hamabo, 19.
heterophyllus, 18.
incanus, 15.
kermesinus, 28.
lasiocarpos, 12.
Leopoldii, 29.
liliiflorus, 24.
Lindlei, 16.
luteolus, 28.
luteus, 28.
major, 1.
Manihot, 6.
Meehanii, 29.
militaris, 9.
miniatus, 28.
Moscheutos, 13.
mutabilis, 27.
occidentalis, 12.
oculiroseus, 14.
pæoniflorus, 29.
palustris, 13.
purpureus, 29.
radiatus, 16.
ranunculæflorus, 29.
Rosa-sinensis, 28.
rosella, 2.
roseus, 13.
ruber, 29.
Sabdariffa, 2.
Schizopetalus, 23.
sinensis, 28.
speciosus, 10, 29.
splendens, 28, and suppl.
sub-violaceus, 28.
syriacus, 29.
tiliaceus, 21.
totus albus, 29.
Trionum, 1.
Van Houttei, 28.
vesicarius, 1.
violaceus, 29.
zebrinus, 28.

KEY TO THE SPECIES.

A. *Plant annual or biennial (sometimes perennial in the case of Nos 3 and 6).*
B. *Habit low and diffuse* ..... 1. **Trionum**
BB. *Habit erect, the plants mostly tall, strict and stout.*
C. *Calyx 5-cleft, not ventricose or spathe-like.*
D. *St. not prickly* ..... 2. **Sabdariffa**
DD. *St. prickly* ..... 3. **cannabinus**
CC. *Calyx long and spathe-like, splitting on one side, deciduous.*
D. *Bracteoles linear.*
E. *Caps. short (3 in. or less)* ..... 4. **Abelmoschus**
EE. *Caps. long and large (5 in. or more)* ..... 5. **esculentus**
DD. *Bracteoles broad and leafy* ..... 6. **Manihot**
AA. *Plant obviously perennial, herbaceous (or sometimes woody below).*
B. *Branches and petioles prickly* ..... 7. **diversifolius**
BB. *Branches and petioles not prickly.*
C. *Bracteoles lobed or forked* ..... 8. **aculeatus**
CC. *Bracteoles entire, not enlarged at apex.*
D. *Foliage glabrous or essentially so.*
E. *Lvs. toothed or lobed* ..... 9. **militaris**
EE. *Lvs. deeply divided* ..... 10. **coccineus**
DD. *Foliage pubescent or tomentose.*
E. *Calyx-lobes ovate or ovate-lanceolate.*
F. *Lvs. hastately 3-lobed* ..... 11. **grandiflorus**
FF. *Lvs. only obscurely angle-lobed* ..... 12. **lasiocarpus**
EE. *Calyx-lobes with triangular outline.*
F. *Fls. rose-color* ..... 13. **Moscheutos**
FF. *Fls. white with reddish center* ..... 14. **oculiroseus**
EEE. *Calyx-lobes ovate to triangular-lanceolate; fls. often yellow.* 15. **incanus**
AAA. *Plant distinctly woody, being a shrub or a tree.*
B. *Branches and petioles prickly. (No. 18 may sometimes lack prickles.)*
C. *Fls. yellow* ..... 16. **radiatus**
CC. *Fls. pink* ..... 17. **cisplatinus**
CCC. *Fls. white* ..... 18. **heterophyllus**
BB. *Branches and other parts usually not prickly or spiny.*
C. *Color of fls. on the order of yellow.*
D. *Involucre an 8–10-toothed cup.*
E. *Species Japanese: a shrub* ... 19. **Hamabo**
EE. *Species tropical; usually small trees.*
F. *The involucre deciduous with the calyx* ..... 20. **elatus**
FF. *The involucre persistent with the calyx* ..... 21. **tiliaceus**
DD. *Involucre of 5 separate bracteoles* ..... 22. **calycinus**
CC. *Color of fls. pink, scarlet, white.*
D. *Petals deeply cut* ..... 23. **schizopetalus**
DD. *Petals entire or essentially so.*
E. *Lf.-margins practically entire (sometimes toothed at apex), or only obscurely crenulate.*
F. *Fls. red* ..... 24. **liliiflorus**
FF. *Fls. white, axillary* ..... 25. **Arnottianus**
FFF. *Fls. white, terminal* ..... 26. **Denisonii**
EE. *Lf. margins lobed or toothed.*
G. *Lvs. downy* ..... 27. **mutabilis**
GG. *Lvs. essentially glabrous.*
H. *Stamens prominently exserted* ..... 28. **Rosa-sinensis**
HH. *Stamens not exserted* ... 29. **syriacus**

1. **Triònum,** Linn. (*H. vesicàrius*, Cav. *H. africànus*, Hort.). FLOWER-OF-AN-HOUR. BLADDER KETMIA. TRAILING HOLLYHOCK. Fig. 1830. Annual, 1–2 ft. high, bushy-spreading, the main branches becoming prostrate, usually hispid-hairy: lvs. 3–5-parted, the upper ones 3-parted, with the middle lobe much the largest, the lobes linear-oblong or sometimes widening

upward, coarsely notched, the root-lvs. undivided: fls. solitary in the upper axils, opening wide in the sunshine but closing in shadow, 1–3 in. across, sulfur-yellow or white, usually with a brown eye; pedicel elongating in fr., and the calyx becoming much inflated. Cent. Afr. B.M. 209.—An interesting annual, blooming freely throughout the hot weather of summer, and thriving in any open, warm place. Seeds are usually sown where the plants are to stand. Excellent for rock-work. It is sometimes a weed in cult. grounds. *H. Trionum* as sometimes defined, has much wider and more spatulate and relatively shorter lf.-lobes, which are round-toothed or lyrately lobed: fls. smaller: and in this case the above description would apply to *H. vesicarius;* but there seems to be insufficient reason for keeping the two distinct. Var. **màjor,** Hort., is offered: 2 ft.: fls. primrose-yellow with deep violet center.

1830. Hibiscus Trionum. (×⅓)

2. **Sabdarìffa,** Linn. (*H. rosélla,* Hort.). Jamaica Sorrel. Roselle. Strong annual, 5–7 ft. high, nearly glabrous, the sts. terete and reddish: root-lvs. ovate and undivided, the upper ones digitately 3-parted, the side lobes sometimes again lobed; lobes lanceolate-oblong and crenate-dentate: fls. solitary and almost sessile in the axils, much shorter than the long lf.-stalks; calyx and bracts red and thick, less than half the length of the yellow corolla. Old World tropics. Gn. 66, p. 428.—Widely cult. in the tropics, and now grown somewhat in S. Fla. and S. Calif. for the fleshy calyxes, which, when cooked, make an excellent sauce or jelly with the flavor of cranberry. The green seed-pod is not edible. The juice from the calyxes makes a cooling acid drink. It thrives in hot, dry climates.

3. **cannabìnus,** Linn. Annual, or sometimes perennial, the st. glabrous and prickly: lower lvs. cordate and not lobed, the upper deeply palmately lobed into narrow serrate parts: peduncle short: bracteoles 7–10, narrow: fls. large, yellow with crimson center, on very short axillary peduncles; sepals lanceolate, bristly, with gland on back of each; corolla spreading: caps. nearly globose, bristly. Old World, and widely grown for a coarse fiber which is known as "Bimlipitam jute."

4. **Abelmóschus,** Linn. (*Abelmóschus moschàtus,* Moench). Annual or biennial, 2–6 ft., hispid: lvs. various, usually palmately 5–7-lobed, the lobes spreading and oblong-lanceolate and coarsely toothed: bracteoles 6–12, linear, ¾in. or less long: fls. 4 in. diam., yellow with crimson center; calyx 15-toothed: caps. 3 in. or less long, oblong-lanceolate in outline, setose. India.—Grown in tropical countries for the musk-scented seeds, which are also sometimes used medicinally; also for the fls. Varies greatly, some of the forms having no lobed lvs.

5. **esculéntus,** Linn. (*Abelmóschus esculéntus,* Moench). Okra. Gumbo. Annual: mostly strict, 2–6 ft. or more, the sts. terete and more or less hispid: lvs. cordate in outline, 3–5-lobed or divided, the lobes ovate-pointed and coarsely toothed or notched: bracteoles very narrow, about 1 in. long: fls. solitary and axillary, on inch-long peduncles, yellow, with a red center: fr. a long ribbed pod (5–12 in. long), used in cookery. Trop. Asia.—For cult., see *Okra.* A large-fld. form (var. *speciosus,* cf. *H. Manihot*) in Gt. 43, p. 623.

6. **Mánihot,** Linn. Fig. 1831. Tall and stout (3–9 ft.), glabrous or somewhat hairy: lvs. large, palmately or pedately 5–9-parted into long and narrow oblong-lanceolate dentate lobes: bracteoles oblong-lanceolate, falling after a time (as does the calyx): fls. large (4–9 in. across), pale yellow (sometimes white), with a purple eye, very showy: caps. oblong and hispid. China and Japan; widely spread in the tropics, and naturalized in the southern states. B.M. 1702; 3152; 7752. S.H. 2:263.—This is apparently the Sunset hibiscus of the trade; also the Queen of the Summer hibiscus. In botanical works, *H. Manihot* is said to be an annual, but as known to horticulturists it is perennial in mild climates, although not persisting long and making its best bloom on young plants. For a discussion of this point as related to the limitations of the species, see G. C. III. 22:249; Gn. 53, p. 127 (and plate 1157). Botanically, the species is allied to *H. esculentus.* Not hardy in the open in the N., but the roots may be taken up in the fall and carried over winter in a warm dry cellar. In the Middle States and S., it may be expected to survive if well mulched. Grows readily from seeds, blooming late the first year if the seeds are started under glass. Var. **dissèctus,** Hort., has the lvs. cut almost to the petiole into narrow lobes.

7. **diversifòlius,** Jacq. Tall and rigid, herbaceous or subshrubby, stiffly pubescent, the branches and petioles bearing stout and short conical prickles: lvs. variable, mostly broad-cordate or nearly orbicular, angular or somewhat 5-lobed, toothed: fls. in axillary or terminal racemes, primrose-yellow with dark red center; sepals linear-lanceolate, bristly; corolla much

1831. Hibiscus Manihot. (×⅓)

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larger than calyx: caps. ovoid, pointed and hispid; seeds glabrous Trop. Afr.; Pacific islands, and Austral., and cult. in E. India. B.R. 381.—Offered in S. Calif.

8. **aculeàtus,** Walt. Herbaceous perennial, not very stout, 2–6 ft. tall, hispid all over but not tomentose nor whitish: lvs. roundish or roundish-ovate in outline, 3–5-lobed or -parted into linear or oblanceolate cut or toothed blunt segms., the sinuses often rounded and enlarging: bracteoles 10–12, linear, forking and bristly, not so long as the calyx: fls. 3–4 in. across, yellow or cream-colored with purple in the base, the petals about 3 in. long and the calyx-lobes lanceolate and bristly. S. C. south in sand, frequently near swamps.—Not hardy N.

9. **militàris,** Cav. Herbaceous perennial, 4–6 ft., strong-growing, glabrous or very nearly so: lvs. rather small, usually hastate (2 short lobes at base), the middle lobe ovate-lanceolate or triangular-lanceolate, long-acuminate, equally crenate-toothed; upper lvs. halberd-form: bracteoles linear or awl-like, nearly or quite half as long as the calyx: fls. 3–5 in. across, white, blush or pale rose, purple-eyed: fr. inclosed in inflated calyx; seeds hairy. Wet places, Pa. to Minn. and south to the Gulf. B.M. 2385.—A hardy and fine species. Forms occur with lvs. not lobed.

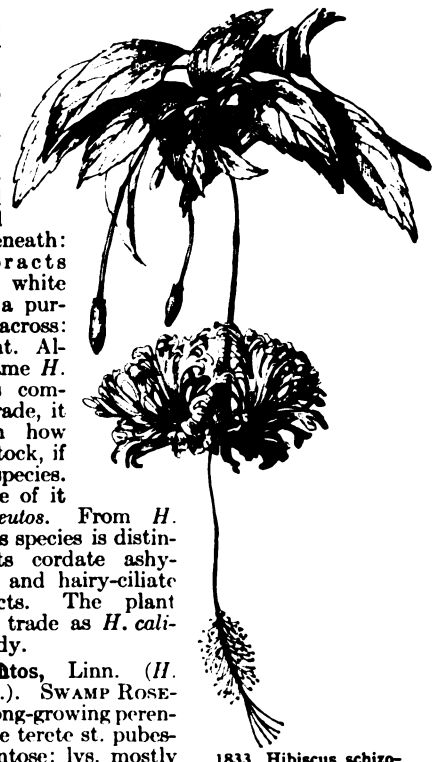
10. **coccíneus,** Walt. (*H. speciòsus*, Ait.). Perennial herb, green and glabrous throughout, glaucous, 3–10 ft.: lvs. palmately lobed, or the lowest and sometimes all of them palmately compound, the divisions long-linear-lanceolate and remotely toothed: bracteoles about 1½ in. long, curved: fls. very large (5–6 in. across), rose-red, the petals obovate and conspicuously narrowed at the base; column of stamens very long. Ga. south in swamps. B.M. 360. R.H. 1858, p. 575; 1866:230.—This fine species is apparently not hardy in the northern states, although there are reports that plants have lived in the open in the neighborhood of Philadelphia. The roots should be stored in a cellar in winter. Plants have been carried over winter under glass when used in hybridizing.

11. **grandiflòrus,** Michx. Perennial herb, tall and stout (3–8 ft.), the terete reddish st. becoming glabrous: lvs. large, 3-lobed, the lobes ovate-acuminate or ovate-oblong-acuminate, the side ones widely spreading, blunt-toothed or even again lobed: bracteoles linear, 1 in.: fls. very large (6–8 in. across), white or rose, with deeper eye. Ga., Fla. west, in swamps.—Aside from the large fls. and lobed lvs., this is very like *H. Moscheutos*. It is doubtful whether the true *H. grandiflorus* is in the trade.

1832. Hibiscus lasiocarpos. (×⅓)

12. **lasiocárpos,** Cav. Fig. 1832. Perennial herb, to 6 ft.: st.: and lvs. pubescent: lvs. ovate, more or less cordate, acuminate, toothed, often angular or slightly 3-lobed, the upper ones narrower: bracteoles linear-subulate and bristly: fls. white or pale rose with darker center, the petals 3–4 in. long: caps. very hairy. Swamps, Ky., west and south. G. F. 1:426 (reduced in Fig. 1832).

Var. **califórnicus** (*H. califórnicus*, Kell. *H. lasiocárpos* var. *occidentàlis*, Gray). Lvs. more uniformly cordate: caps. less hairy; seeds papillate: marshy places along San Joaquin and Sacramento Rivers. It is strong-growing, to 7 ft., the st. terete or slightly grooved above, more or less pubescent: lvs. distinctly cordate, ovate, acute, shallow-toothed and not lobed, dull ashy gray beneath: involucre-bracts hairy: corolla white or rose, with a purple eye, 3–5 in. across: caps. pubescent. Although the name *H. californicus* is common in the trade, it is a question how much of the stock, if any, is this species. Certainly some of it is *H. Moscheutos*. From *H. Moscheutos* this species is distinguished by its cordate ashy-tomentose lvs. and hairy-ciliate involucre-bracts. The plant known to the trade as *H. californicus* is hardy.



1833. Hibiscus schizopetalus. (×½)

13. **Moscheùtos,** Linn. (*H. palùstris*, Linn.). Swamp Rose-Mallow. Strong-growing perennial 3–8 ft., the terete st. pubescent or tomentose: lvs. mostly ovate, entire in general outline or sometimes shallowly 3-lobed at the top, crenate-toothed, very soft-tomentose beneath but becoming nearly or quite glabrous above, the long petiole often joined to the peduncle: bracteoles linear, nearly or quite as long as the tomentose calyx: calyx-lobes triangular-ovate; fls. very large (4–7–8 in. broad), light rose-color: caps. globose-ovoid, glabrous. Marshes along the coast from Mass. to Fla. and west to Lake Michigan. B.M. 882. B.R. 1463; 33:7. Mn. 2:161. Gng. 2:227. F.S. 12:1233. R.H. 1907, p. 203 (as var. *palustris*). G.W. 6, p. 63. *H. ròseus*, Thore, of Europe, is considered to be a naturalized form of this American species. R.H. 1879:10.—One of the best of the rose-mallows, thriving in any good garden soil. Of easiest cult. and perfectly hardy. Blooms in Aug. and Sept. The foliage is strong and effective. The most generally cult. of the hardy herbaceous kinds.

14. **oculirùbeus,** Brit. Crimson-Eye Rose-Mallow. Resembles *H. Moscheutos:* differs in fls. being white with dark crimson center, calyx-lobes triangular-lanceolate and nearly twice as long as broad, caps. ovoid-conic and long-pointed. Marshes near the coast, N. J. southward.

15. **incànus,** Wendl. Much like *H. Moscheutos*, and probably sometimes passing for it in the trade: lvs. smaller and narrower, ovate-lanceolate, rarely lobed, serrate-toothed: fls. sulfur-yellow, pink or white with a crimson eye: caps. ovoid and beaked, stellate-tomentose and loosely hairy. Md. and south in swamps.—Seems to be hardy in the N. with a mulch protection.

16. **radiàtus,** Willd. (not Cav.). Woody shrub, 3–4 ft., armed on branches and petioles with small prickles: lvs. rather narrow, deeply palmately divided, 3–5-lobed, or uppermost simple, the lobes broad-lanceo-

late and serrate; stipules linear: bracteoles 8–10, linear, forked: fls. axillary and solitary, yellow with crimson center; calyx not glandular. India, Java. Widely cult. in tropics. Var. **flòre-purpùreo,** Hook., has rose-purple fls. B. M. 5098. Var. **Líndlei** (*H. Líndlei*, Wall.) has deep purple fls. B.R. 1395.

1834. Hibiscus Rosa-sinensis. (×⅓)

17. **cisplátinus,** St. Hil. Bushy, 3–5 ft.: sts. glabrous but prickly: lvs. deltoid-lanceolate or deltoid-ovate, 3-lobed, coarsely toothed, sparsely hairy on the veins: fls. solitary, 4–5 in. across, light pink, with darker color in the eye and sometimes darker on the margins. Brazil (this side the Platte River, whence apparently the specific name). R.H. 1898:480. Gng. 7:50.—Little known in this country. It is a handsome late fall bloomer, and may be planted out in summer. It seeds freely, and these, sown as soon as ripe, will give blooming plants for the following fall.

18. **heterophýllus,** Vent. Tall shrub, glabrous except on infl. and very young shoots, the branches often prickly: lvs. varying from linear to lanceolate and elliptic-oblong and from entire to 3-lobed, 5–6 in. long, usually serrulate and sometimes white beneath: fls. large (3–4 in. long), white with a deep crimson eye, the calyx tomentose: caps. hairy; seeds glabrous. Austral.; intro. in S. Calif., where it is a free and showy bloomer.

19. **Hamàbo,** Sieb. & Zucc. Shrub, 6–10 ft. high, closely pubescent: lvs. roundish. with an abrupt short point, irregularly shallowly toothed, or wavy, white tomentose beneath and green or grayish hairy above: involucre of scales united at the base: fls. solitary in the upper axils, large, yellow, with a darker base, about 3 in. across.—A Japanese species offered by importers but not yet tested in this country, and probably not hardy south of the southern-middle states. Said to be cult. in Japan.

20. **elàtus,** Swartz (*Parítium elàtum*, Don). Mountain Mahoe. Spreading small tree: lvs. round-cordate, short-cuspidate, entire, hoary beneath: involucre deciduous with the calyx, 8–10-toothed: fls. 4 in. long, opening primrose-color in the morning, then changing, as the day advances, to orange and deep red: seeds hairy. W. Indies.—This species, the next, and probably others, yield the Cuba bast, used for tying cigars and for other purposes. Lvs. and shoots medicinal: wood durable.

21. **tiliàceus,** Linn. (*Parítium tiliàceum*, Juss.). Round-headed tree, 20–30 ft. high, sometimes a tall shrub: lvs. round-cordate and short-acuminate, entire or obscurely crenate, hoary beneath: involucre persistent with the calyx, 10-toothed or -cut: fls. 2–3 in. long, yellow: seeds glabrous or very nearly so. Fla. keys and W. Indies, but widespread in tropics and probably of Old World origin. Sprouts from the base if frozen.

22. **calycinus,** Willd. (*H. chrysánthus*, Hort.). Small slender shrub: pubescent: lvs. long-stalked, round-cordate, somewhat 3–5-angled and 5–7-nerved, crenate, hairy or velvety: stipules subulate: fls. on axillary peduncles which are shorter than the petioles, large, yellow, with a dark center: involucre bracts 5, bristle-pointed: caps. tomentose. S. Afr.—To be grown indoors, but may be planted out in the summer with good results. Probably valuable for permanent planting in the extreme S.

23. **schizopétalus,** Hook. f. Fig. 1833. Tall glabrous shrub with slender drooping branches: lvs. ovate-elliptic, toothed: bracteoles minute: fls. pendulous, on long jointed peduncles, red or orange-red, the recurved petals beautifully and deeply cut; calyx tubular; stamens long-exserted: fr. long, bearing smooth seeds. E. Trop. Afr. B.M. 6524. F.S. 23:2397, 2398. G.Z. 25, p. 241.—A beautiful species, for the warmhouse; grown in the American tropics.

24. **liliiflòrus,** Cav. (*H. Genèvii*, Bojer). Shrub, glabrous: lvs. petioled, ovate, 2–4 in. long, entire or crenate, often few-toothed at apex, obtuse or acute, rounded at base, the young ones sometimes deeply parted: bracteoles 5, linear, connate at base: fls. solitary in upper axils, long-peduncled, bright red; sepals 1½ in. or less long, lanceolate, connate above the middle; corolla funnel-shaped; stamens equaling corolla or somewhat exserted. Mauritius and Seychelles Islands. B.M. 3144.—An excellent glasshouse species, of several varieties.

25. **Arnottiànus,** Gray (*H. Faùriei*, Leveil.) Tree, 20–30 ft.: lvs. large, ovate, short-acuminate, entire, 3-nerved, stiffish, shining: bracteoles 5–7, triangular to lanceolate: fls. axillary and solitary, very large, white, sometimes with pinkish veins; calyx tubular, 5-toothed; stamens long-exserted, white or red. Hawaii; cult. there, and intro. in S. Calif.

26. **Dénisonii,** Burb. Small glasshouse shrub, flowering when very small, glabrous: lvs. thick and rather stiff, slender-stalked, elliptic-ovate, entire or obscurely crenulate, acuminate, dull green: fls. terminal, large, white, 4–5 in. across. Nativity unknown, but intro. from Austral. F.M. 1876: 232. G.Z. 22: 217.—A good greenhouse plant, requiring warm temperature; apparently little grown.

1835. Hibiscus syriacus. (×½)

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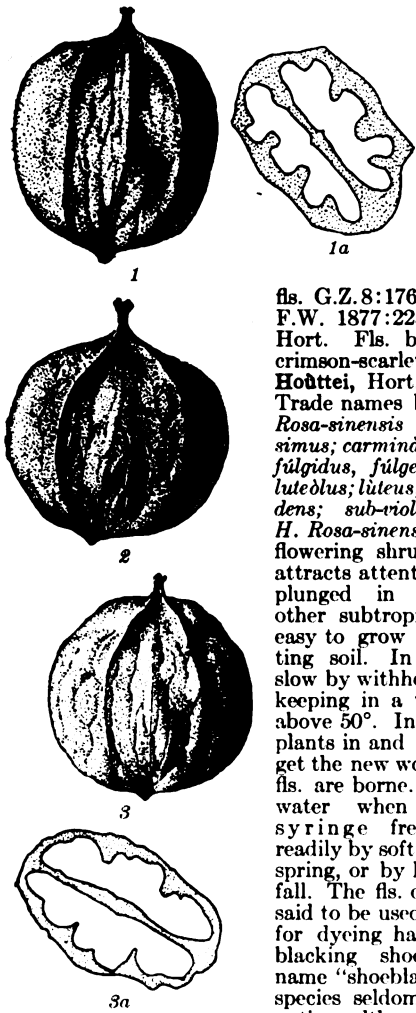
27. **mutábilis,** Linn. Tree-like: lvs. cordate, 5-angled and toothed, downy: bracteoles shorter than calyx: fls. axillary, opening white or pink but changing to deep red by night, 3–4 in. across; sepals ovate-lanceolate, joined below the middle: caps. globose, hairy; seeds hispid. China. H.F. II. 11:80.—Cult. in tropical and subtropical regions. Intro. in S. Fla. under the name of "cotton rose" and "confederate rose."

28. **Rósa-sinénsis,** Linn. (*H. sinénsis,* Hort.). Chinese Hibiscus. Fig. 1834. In glasshouses a shrub 3–8 ft. high, but reaching 30 ft. in subtropical regions and becoming tree-like: glabrous: lvs. rather large, thin and shining green, broad-ovate to lance-ovate, somewhat tapering to the base, acuminate, coarsely and unequally toothed: bracteoles linear, free, as long as the calyx: fls. solitary in the upper axils of the new growth, on peduncles which exceed the petioles, bright rose-red, 4–5 in. across, with a projecting red column of stamens and pistil; sepals lanceolate, joined below the middle: caps. ovoid, glabrous, the valves terminating in a short beak. Asia, probably China: now distributed in warm countries, and one of the best known old-fashioned conservatory pot-plants, and one of the characteristic plants in tropical countries. B.M. 158. I.H. 29:441. G.C. III. 2:529. Gn. 53, p. 127.—It is now immensely variable. Forms are double-fld., and others are orange, yellow, bright red, magenta, and particolored. Var. **Coòperi,** Hort. (*H. Coòperi,* Hort.), has narrow white-marked lvs. and distorted scarlet fls. G.Z. 8:176. H.F. II. 6:210. F.W. 1877:225. Var. **Cálleri,** Hort. Fls. buff-yellow with crimson-scarlet base. Var. **Van Houttei,** Hort., deep crimson. Trade names belonging to *H. Rosa-sinensis* are *brillantíssimus; carminàtus, chrysánthus; fúlgidus, fúlgens; kermesìnus; luteòlus; lùteus; miniàtus; spléndens; sub-violàceus; zebrìnus. H. Rosa-sinensis* is a summer-flowering shrub which always attracts attention. It is often plunged in the open with other subtropical stuff. It is easy to grow in ordinary potting soil. In winter keep it slow by withholding water and keeping in a temperature not above 50°. In spring head the plants in and start them up to get the new wood on which the fls. are borne. Give plenty of water when growing, and syringe frequently. Prop. readily by softwood cuttings in spring, or by hard cuttings in fall. The fls. of this plant are said to be used in some places for dyeing hair and also for blacking shoes, whence the name "shoeblack plant." The species seldom seeds in cultivation, although it is reported as seeding freely in some tropical regions.



1836. Forms of Carya ovata. 1, 1*a*, Meriden; 2, Jackson; 3, 3*a*, Milford.

29. **syríacus,** Linn. (*Althæa frùtex,* Hort.). Shrubby Althea. Rose of Sharon. Figs. 1828, 1835. Shrub, 6–12 ft. high, sometimes almost tree-like, much branched, nearly or quite glabrous: lvs. rather small, short-petioled, strongly 3-ribbed, triangular- or rhombic-ovate, lower ones mostly 3-lobed and with many rounded teeth or notches: bracteoles linear, 6 or 7: fls. solitary in the axils on the young wood (late in the season), short-peduncled, somewhat bell-shaped, 2–3 in. long, rose or purple, usually darker at the base; sepals ovate-lanceolate, exceeding the bracteoles: pod short, splitting into 5 valves. Asia. B.M. 83. R.H. 1845:133 (var. *speciosus,* with double fls.). Gn. 75, p. 604. J.H. III. 55:473. G.W. 13, p. 65. G.Z. 24:97. J.F. 4: pl. 370. G.7:149; 11:167. F.E. 25:459; 32:127.—One of the commonest of ornamental shrubs, and hardy in Ontario; commonly known as althea. It is immensely variable in character of fls., the colors ranging from blue-purple to violet-red, flesh-color and white; also full double forms. There are forms with variegated lvs. Colored plates of some of the double-fld. forms will be found in Gn. 52:504. The species thrives in any good soil. Prop. by seeds, by cuttings of ripened wood taken in the fall, and named varieties by grafting on the common seedling stock. Nativity uncertain, but probably not Syrian, as Linnæus supposed: probably native in China. To this species belongs the trade name *H. Lèopoldii.* There are many horticultural forms of this interesting late summer-flowering shrub. Var. *Meèhanii,* Hort., is a variegated-lvd. form of somewhat dwarf habit, and single fls. 3–4 in. across, lavender, and purple-blotched. Other trade names that belong with *H. syriacus* are: *amplissimus,* double, purple-pink with carmine center; *anemonæflòrus; atrórubens; bicolor,* semi-double, white with dark center; *camelliæflòrus; cœléstis; elegantíssimus; Lèopoldii; pæoniflòrus; purpùreus; ranunculæflòrus; rùber; speciòsus; tòtus álbus; violàceus.*

H. aponeùrus, Sprague & Hutch. Shrub, to 4 ft.: lvs. small, ovate or elliptic, sometimes slightly 3-lobed: fls. solitary, axillary, 1 in. across, brilliant scarlet. Trop. E. Afr. B.M. 8231.—*H. Archeri,* Hort., is a hybrid of H. Rosa-sinensis and H. schisopetalus, raised by A. S. Archer, Antigua, W. Indies. Much like H. Rosa-sinensis. Fls. red. Gn. 55:310.—*H. Cámeronii,* Knowles & West. Tall shrub, with heart-shaped 3-lobed lvs. and large, solitary, cream-colored, red-veined fls. Madagascar. B.M. 3936. H.U. 3, p. 42. The plant figured under this name in Gn. 53:280 is probably a form of H. Rosa-sinensis.—*H. cùpreus,* Pampan. Allied to H. Rosa-sinensis: branches coppery purple in color: lvs. lanceolate, undulate and usually entire: bracteoles 6–8, linear: fls. nearly 2 in. long, purple with carmine eye. Ceylon.—*H. Kókio,* Hildeb. Tree: lvs. ovate or elliptic-oblong, crenate, glabrous: fls. axillary and solitary, red, the petals to 2½ in. long; staminal column red, not long-exserted. Hawaii.—*H. Pátersonii,* R. Br.=Lagunaria.—*H. puníceus,* Hort., apparently has no botanical standing: still offered abroad. G.Z. 19:1.—*H. Scóttii,* Balf. Large bush or small tree from Isl. of Socotra: lvs. ovate, entire, 3-lobed, or toothed: fls. 3½ in. across, bright golden yellow with carmine eye. B.M. 7816.—*H. splèndens,* Fras. Shrub, 12–20 ft., soft-tomentose, prickly: lvs. cordate-ovate, palmately 3–5–7-lobed: fls. very large, rose-red. Austral. B.M. 3025. B.R. 1629. Handsome.—*H. surattènsis,* Linn. Trailing, with palmately 3–5-parted lvs.: fls. yellow: involucre-bracts with odd nail-like spines. India, but widely distributed. G.C. III. 9:529.—*H. venùstus,* Blume. Very like H. mutabilis, but involucre-bracts broad. Java. B.M. 7183.—*H. villòsus,* undetermined trade name.—*H. Waimeæ,* Heller. Tree, 20–30 ft.: lvs. suborbicular, crenate, pubescent on both sides: fls. axillary near ends of branches, large, white or tinged with pink; staminal column red, long-exserted. Hawaii. G. C. III. 57:8.

L. H. B.

HICKORY-NUT. Notwithstanding the high esteem in which the nuts of several species of hickory have been held since the settlement of America by the white men, but little progress has been made in their domestication and improvement. Out of the nine or ten species recognized by botanists, not more than three or four have been found sufficiently promising from an economic standpoint to justify conspicuous effort at amelioration. Of these the pecan (*Carya Pecan*) stands easily first, followed in order of apparent value by the shagbark (little shellbark), *C. ovata;* the shellbark (big shellbark), *C. laciniosa,* and the pignut, *C. glabra.* The pecan differs in its requirements of soil and climate from the other species, and is described

separately under *Pecan*. For the botany of the hickories, see *Carya*.

In flavor and quality of kernel, the shagbark is esteemed by most Americans as the choicest of native nuts, though in these respects the shellbark is but little inferior to it. The thinner shell and larger proportion of kernel have given the former precedence over the latter in most cultural efforts; though the thrifty growth, symmetrical form and luxuriant foliage of the latter render it one of the most handsome and useful of native trees for roadside or lawn planting. The shagbark has the broader area of natural distribution, being found in localities throughout most of the United States to the eastward of the Great Plains, except on the lowlands of the South Atlantic coast and Gulf states. The shellbark is mainly confined to the valley of the Mississippi and its larger tributaries, extending eastward, however, into eastern Pennsylvania and western New York.

The pignut, which is similar to the shagbark in area of distribution, is much inferior to the others in quality, but shows wider variation than either in this respect, and has disclosed at least one variety of distinct cultural merit.

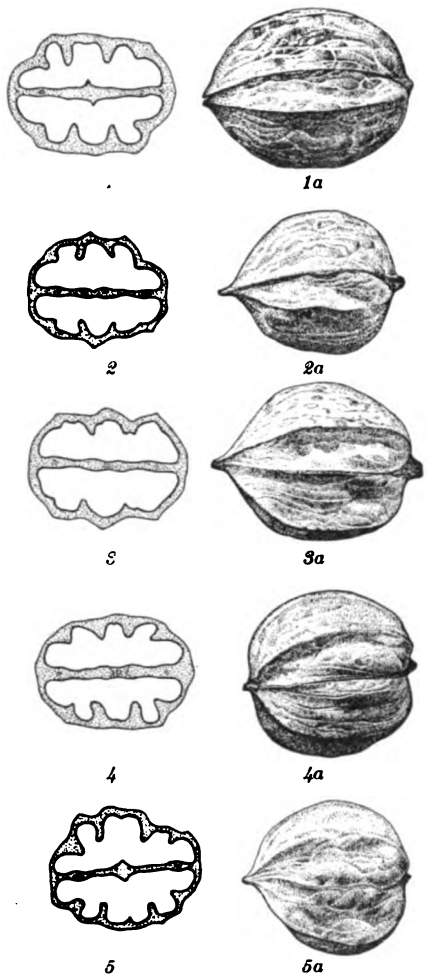
As the hickories, other than the pecan, are slow-growing species at best, they should not be planted on other than fertile soil. The shellbark is native to river bottoms, and requires richer land than the others, which endure a rather wide range of soil characteristics, provided there is sufficient depth and good drainage. Deep, well-drained fertile loams, either of sandy or clayey nature, are acceptable to all the species.

Propagation.

All the species are propagated by seed. Planting is frequently done in autumn, but, to lessen the destruction by rodents, is more safely done in early spring. In such case the freshly gathered nuts, after removal from the hulls, should be stored in slightly dampened sand during the winter or stratified, as other tree seeds. Uniformity of growth is promoted by planting nuts where trees are to stand, as the transplanting process in ordinary seasons is accompanied by a considerable loss. If trees must be transplanted, it is probably best to transplant annually in nursery rows, in rich soil, to promote growth of fibrous roots and lessen the shock of final transplanting to the permanent location.

The propagation of the hickories (except the pecan) by budding and grafting, is exceedingly difficult, even the most experienced propagators securing but a partial stand in the nursery, under favorable conditions. This fact coupled with the comparatively high mortality in transplanting such trees from the nursery has greatly retarded the dissemination of the many choice varieties that have been located in the form of seedling trees, during the past quarter-century.

One of the simplest methods of multiplying the stock of a choice tree, to a limited extent, and thus to insure the preservation of the variety, is that suggested by Fuller in his "Nut Culturist," which was apparently one of the first methods successfully employed in shagbark propagation. This consists in the "turning up or exposing at the surface of the ground of side roots, severed from the parent tree." The severed side roots are straightened up and tied to stakes to hold them in position with their cut ends about level with the surface of the ground to stimulate the formation of shoots from adventitious buds, one of which is eventually made the trunk of the new tree. The lower end of the root is not severed until the top has formed, when the new tree should be transplanted to its permanent location in rich and mellow soil and kept well mulched until thoroughly established. The method is slow and sharply limited in extent of application but is perhaps the surest in the hands of the amateur grower.



1837. Forms of hickory-nut. 1, 1*a*, Kentucky; 2, 2*a*, Kirtland; 3, 3*a*, Rieke; 4, 4*a*, Swain; 5, 5*a*, Weiker.

The late Jackson Dawson, the very skilful propagator of woody plants at Arnold Arboretum, achieved a considerable degree of success in propagating the shagbark by side-grafting on specially grown bitternut (*C. minima*) seedlings. He grew the seedlings in boxes 4 inches deep, for one or two years until of sufficient size for grafting. The seedlings were then transferred to pots in autumn and taken into the greenhouse about January 1. They were side-grafted, close to the collar. As soon as the roots began to start, the potted trees were plunged in sphagnum to the top bud of the cion and left until March to callus.

As improvement in method and technique in pecan-propagation has been accomplished by southern nurserymen during the past ten years, considerable attention has been given to the hickory by some of them, with the result that a certain degree of success has been attained with the annular and patch-bud methods, both in nursery propagation and top-working. Unfortunately, in many cases, the shagbark has been budded upon southern pecan seedlings, the ability of which to endure the minimum temperatures of the northern regions where the principal interest in shagbark planting exists is at least very doubtful.

The cleft-grafting of thoroughly established stocks at the crown, in early spring, has thus far proved the most practical method for the average propagator. This is accomplished by removing the earth to a depth of 3 to 4 inches from the base of the tree. The stock is cut off with a fine saw about 2 inches below the ground-line or at the top of the root-swelling. Cions having terminal buds should be inserted by either center or side-graft methods. The entire stump should then be carefully mounded over to the top buds of the cion with fine earth of a texture that will retain moisture without baking. The cions should be cut when entirely dormant and held in sphagnum or sawdust in an ice-house or elsewhere to keep the buds from swelling until the stocks are starting. The young growth needs to be

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carefully staked until the wood has hardened, as it is soft and easily broken. See *Grafting*.

Planting.

The hickories are transplanted with such difficulty that the utmost care in preparing the soil for them is required. This should be rich, deep and thoroughly drained. Planting may be done either in autumn or early spring. Pruning should be restricted to the removal of bruised or injured roots. Heavy mulch should be applied and maintained until trees are thoroughly established. After that little attention is required.

Production and use.

The fairly abundant supply of shagbarks and shellbarks in our markets is derived entirely from seedling trees. By far the larger part of this is from second-growth trees in fence-rows or the open fields where the conditions are more favorable to nut-production than in the forests. In southern New England, New York, New Jersey, Pennsylvania, Ohio and Indiana, the shagbark product is a highly prized supplemental crop on many farms. In some sections, as in southeastern Pennsylvania, the nuts are cracked by the women and children, the shelled meats being marketed in considerable quantities at satisfactory prices, many consumers preferring them to any other nut.

Varieties.

As the attention of amateurs has been concentrated on the subject in recent years, many wild trees yielding choice nuts have been located and preserved. A considerable number of these have received varietal names, but only a few have actually been propagated in such way that trees are obtainable at nurseries even in small numbers.

The qualities that should be considered in shagbarks and shellbarks from the commercial viewpoint are: (1) cracking quality, including easy release of the kernel; (2) thinness of shell; (3) size of nut; (4) plumpness and flavor of kernel; (5) productiveness.

The following sorts are worthy of consideration by those who are interested in testing representative sorts. Not all of them are yet to be had from nurseries.

Shagbarks.

Curtis.—Connecticut. A smooth nut of medium size, slightly compressed; kernel plump, light in color and of good quality; shell thin; cracking quality good.

Dover.—Pennsylvania. A medium-sized angular nut, rather broad at the base, but having a long and sharp basal point; shell moderately thin; cracking quality good; quality good.

Eliot.—Connecticut. Of medium size, compressed, angular, ovate, with prominent tip; kernel plump; flavor mild and pleasant; shell thin; cracking quality good.

Hales (*Hales Papershell*).—New Jersey. Large, quadrangular, slightly compressed, with a peculiar wavy surface; kernel rather deeply corrugated, but plump and of good quality, retaining its sweetness for two years or more; shell thin and of fair cracking quality. The Hales nut is the first-named variety of hickory, having been described and illustrated by A. S. Fuller in "The Rural New Yorker" in 1870. It is probably the only sort now obtainable at the nurseries. The original tree bears a fair crop annually, and numerous younger trees grafted from it are now in bearing.

Jackson.—Ohio. A compressed oval nut of large size; kernel large, plump, and of excellent quality; shell thin; cracking quality medium. Fig. 1836.

Kentucky.—Northern Kentucky. A nut of medium size, with quite angular and somewhat lumpy surface, short, sharp apex and flattened base, having a very short tip; shell moderately thin, kernel very plump, rich and sweet. Fig. 1837.

Kirtland.—Quadrangular, above medium size, slightly ridged and having a rather lumpy surface; shell thin, with excellent cracking quality; kernel plump, rich and of good flavor. Fig. 1837.

Leaming.—Missouri. A large nut of fine flavor and excellent cracking quality; the kernel coming out in unbroken halves.

Meriden.—Connecticut. Large, oblong, compressed; kernel large and of good quality; shell rather thick but cracks well. Fig. 1836.

Milford.—Massachusetts. A compressed ovate nut, medium to large in size, with large, plump kernel of excellent quality; cracks well; one of the best nuts yet brought to notice. Fig. 1836.

Rice.—Ohio. Angular, ovate, medium to large in size; kernel plump, bright and of fine quality; shell thin and of good cracking quality; tree regularly productive.

Swain.—Indiana. A rather long nut of medium size, with sharp apex and irregularly pointed base; surface rough; shell thin; cracking quality fair; kernel plump and sweet. Fig. 1837.

Vest.—Virginia. Of medium size, distinctly quadrangular with very lumpy surface; shell very thin and papery; kernel deeply corrugated but plump and of good quality.

Woodbourne.—Pennsylvania. Long, compressed ovate, large and smooth; kernel tender and of very high quality; shell rather thick but cracks well.

Shellbarks.

Lefevre.—Pennsylvania. Large, quadrangular, slightly ridged; shell thin, cracking fairly well; kernel very large, plump, rich and sweet.

Rieke.—Illinois. Above medium size, elongated, with a long, sharp apex and flattened base; shell moderately thick, cracking quality very good; kernel fairly plump and sweet. Fig. 1837.

Weiker.—Pennsylvania. Large, elongated, with moderately thick shell, cracking easily; kernel plump, rich and of good flavor. Fig. 1837.

Pignut.

Of the somewhat numerous sweet-flavored forms found in this species, the following one at least has been deemed worthy of perpetuation because of its delicate flavor, thin shell, and excellent cracking quality.

Brackett.—Iowa. Roundish compressed, smooth and of grayish color, medium to large in size; kernel plump, sweet and of delicate flavor; shell very thin, and easily freed from the kernel.

WM. A. TAYLOR.

HICÒRIA: *Carya.*

HIDÁLGOA ("after the Mexican Hidalgo"). Syn., *Chìldsia. Compósitæ.* A tender herbaceous vine, allied to Dahlia, with scarlet flowers about 2½ inches across, introduced in 1899 by John Lewis Childs, under the name of *Childsia Wercklei*, or "treasure vine."

Hidalgoa is closely allied to Dahlia and Coreopsis, but differs from both in the large, fertile achene of the rays and in the sterile disk-fls., the styles of which are entire or very shortly 2-lobed.—Only 2 species were hitherto recognized, both from Cent. Amer. From these *H. Wercklei* differs in its more compound lvs. and much larger heads. Suitable for cool, shady verandas but cannot be grown north of Washington out-of-doors; quite hardy in S. Calif.

Wércklei, Hook. (*Chìldsia Wércklei*, J. L. Childs). CLIMBING DAHLIA. Tall, woody at base, much branched, climbing by petioles: lvs. opposite, pinnately ternatisect, 1½–2½ in. long, 2 in. wide, the teeth tipped reddish brown; petiole 1½–2 in. long, coiled at base: peduncle axillary, as long as the lvs., 1-fld.; rays about 10, "dazzling orange-scarlet." Costa Rica. B.M. 7684. J. L. Childs' Cat. Rare Flowers, etc., 1899, p. 1, with colored plate. A.G. 20:570.

WILHELM MILLER.
N. TAYLOR.†

HIERÀCIUM (Greek, *a hawk;* it is said the ancients thought that hawks sharpened their eyesight by using the sap of these plants). *Compósitæ* (*Cichoriàceæ*). HAWK-WEEDS. Hardy herbaceous perennials, some of which are bad weeds in the eastern states.

Leaves often toothed, but never deeply lobed: heads usually small, loosely paniculate or cymose, rarely solitary; receptacle flat, usually quite naked; rays truncate, 5-toothed at the apex; anthers sagittate at the base; style-branches slender: seeds angular.—Over 400 species mostly native to Eu. and S. Amer. The genus passes into Crepis, from which it is distinguished by having stiff, usually brownish, rarely white pappus, and oblong or columnar seeds.

The cultivated species bear in summer and autumn a succession of small yellow or orange-colored flowers. There is one white-flowered species, *H. nivale*. They are often worth growing in rockeries and waste places, but care should be taken to prevent them from crowding out more desirable plants. In some parts of the East *H. aurantiacum* has become one of the worst weeds ever introduced into America. It is magnificently colored, and makes very attractive patches. *H. villosum* is the most desirable species. Hawkweeds will grow in almost any soil or aspect. They are propagated chiefly by dividing the stolons, or by seeds, and

if left to themselves will soon form a dense mat of herbage over the poorest of soils. The Old World species are much confused.

A. *Flowering st. leafless or with 1–5 lvs.: lvs. mostly in a rosette at base of st.*

B. *Scapes unbranched above, bearing but a single head.*

Pilosélla, Linn. MOUSE-EAR HAWKWEED. St. slender, 4–12 in. high, stoloniferous, densely hairy throughout: lvs. entire, oblong or spatulate, narrowed into a petiole: fls. 1 in. broad, pale yellow, sometimes striped or tinged with red or purple.—Commonly flowers the whole season. Intro. from Eu. and common in dooryards and fields; often as a troublesome weed. Ont. to Pa. and Mich.

BB. *Scapes branched above, bearing several to many heads.*

C. *Basal lvs. coarsely toothed.*

vulgàtum, Fries (*H. umbròsum*, Jord.). St. 1–3 ft. high, slightly glaucous: basal lvs. 2–5 in. long, oblong to lanceolate, acute at both ends, petioled; petioles usually pubescent: fl.-stalks straight, sticky. July–Sept. Intro. from Eu. and Asia. Lab. to N. J.

CC. *Basal lvs. entire or very finely toothed.*

D. *Lvs. mostly obovate to ovate, purple-veined.*

venòsum, Linn. RATTLESNAKE WEED. St. 1–3 ft. high, slender, smooth or nearly so: lvs. 1–4 in. long, obovate to spatulate, subsessile: fls. ½–¾in. wide, bright yellow. Aug., Sept. Dry woods, Maine to Ga. and west to Manitoba and Neb.—A common plant in woods and, as an escape, a very troublesome weed. Advertised by one dealer in native plants.

DD. *Lvs. mostly spatulate to oblong, green-veined.*

aurantiacum, Linn. ORANGE HAWKWEED. DEVIL'S-BIT. St. 6 in. to 2 ft. high, slender, somewhat hairy: heads ½–1 in. across, short-stalked, orange to orange-red. June–Oct. Naturalized from Eu. by roadsides and in fields, Ont. to Pa.—A bad weed if allowed to spread. It is worthy of being established in high and dry parts of a rockery, where few other plants can grow.

præáltum, Vill. (*H. stoloníferum*, Bess.). Plants usually spreading very rapidly by stolons: st. 2–3 ft. high, slender, glaucous, hairy at base: basal lvs. entire: heads ½in. across, in an open cyme, bright yellow. June–Sept.—Naturalized from Eu. along roadsides in N. Y.; sometimes troublesome in cult. land.

AA. *Flowering st. leafy, at least below.*

B. *St. branching from the base.*

ramòsum, Waldst. & Kit. Lvs. ovate to lanceolate, narrowed at the base, toothed, hairy on margin and beneath; lower lvs. petioled, upper ones subsessile. July–Sept. Eu.

nivàle, Froel. WHITE HAWKWEED. Differs from *H. ramosum* chiefly in having white fls. and glaucous, somewhat leathery lvs., which are not hairy on the margin. A white hawkweed is advertised and, according to some, this is the only white-fld. species in the genus. Tyrolese Alps.

BB. *St. unbranched below.*

C. *Whole plant silky-villose.*

villòsum, Jacq. SHAGGY HAWKWEED. St. 1–2 ft. high, often 4 ft. under cult.: basal lvs. oblong-lanceolate to lanceolate, narrowed at the base, finely toothed; st.-lvs. sessile, the upper half clasping: fls. 1½–2 in. across, bright golden. June–Aug. Eu. Gn. 46:542. G.M. 44:596.—The silvery foliage and showy fls. of this species make it more desirable for the garden than any other hieracium now in cult. It is easily kept from spreading.

CC. *Plant smooth or slightly pubescent.*

canadénse, Michx. St. 1–5 ft. high, slender: lvs. ovate-oblong to lanceolate, acute, serrate or deeply incised, sessile, the upper with clasping base: fls. 1 in. across, the outer involucral bracts spreading. June–Aug. Dry woods, Nova Scotia to Pa., west to Brit. Col. and Ore.

Grondvii, Linn. St. 1–3 ft. high, stiff: lvs. hairy, the upper oval or oblong, broadly sessile, the lower obovate to spatulate, narrowed into a short petiole: fls. ½–¾in. wide. Sandy soils. Canada to Fla., west to Mo. and La.

H. alpinum, Linn. Lvs. oblong or lanceolate, slightly toothed: fl.-sts. about 6 in. high, bearing 1–3 small, narrow lvs. and a single rather large head of bright yellow fls. Mountains of N. Eu. and Asia and the higher ranges of Cent. and S. Eu.—*H. Bórnmuelleri*, Freyn. Resembling H. villosum but lvs. thicker and more woolly, and fl.-heads larger and brighter yellow. Asia Minor.—*H. marginàtum*, Froel. A glaucous erect perennial, the leafy branches widely spreading: lvs. linear-lanceolate, st.-clasping at the base, the margins toothed and the under side reticulated: peduncles quite naked. Habitat(?). Little known in U. S.

S. W. FLETCHER.
N. TAYLOR.†

HIERÓCHLOË (Greek, *hieros*, holy, and *chloe*, grass). *Gramineæ*. Fragrant perennial grasses with flat blades and terminal panicles; only rarely planted. Spikelets with 1 terminal perfect and 2 lateral staminate florets, usually shining brown.—Species about 13, temperate and arctic regions of both hemispheres. This genus contains the fragrant vanilla-grass, the sterile shoots of which are woven by the North American Indians into small mats, baskets and boxes. These retain their fragrance for years. The seed seems to be nowhere obtainable, and only one American dealer advertises plants of it. The odor is like that of the common perennial sweet vernal grass, *Anthoxanthum odoratum*, but is more powerful. Hierochloë is closely allied to Anthoxanthum, but is distinguished by the staminate lateral florets and rather loose panicles, Anthoxanthum having sterile lateral florets and contracted panicles.

1838. Hierochloe odorata.

odoràta, Wahl. (*H. boreàlis*, Roem. & Schult. *Savastàna odoràta*, Scribn.). VANILLA-GRASS. HOLY-GRASS. SENECA-GRASS. SWEET-SCENTED GRASS. Fig. 1838. Rather slender, smooth, 1–2 ft. high: lvs. short: panicle brownish, spreading, 2–4 in. long. June, July. Eu., N. Amer. B. B. 1:132. Dept. Agric., Div. Agrost. 20:56. A. S. HITCHCOCK.

HILLEBRÁNDIA, (Wm. Hillebrand, author of a flora of Hawaii). *Begoniàceæ.* One of the 4 genera of the family, represented by a single Hawaiian species, *H. sandwicénsis,* Oliver. It is a begonia-like succulent herb with alternate long-petioled obliquely cordate 5- to 9-lobed lvs. and bright pink or rose-colored showy fls. in a peduncled corymb: from Begonia it differs in having the ovary free in its upper third, and bearing petaloid organs in the female fls.: petals 5 in both male and female fls.; stamens many; styles 5, fleshy: caps. globose, opening at apex, not winged. The plant grows 2–5 ft. high, from a tuberous rhizome, sparsely hairy or glabrate. It inhabits deep ravines or near waterfalls in different islands of the Hawaiian group. B.M. 6953. G.C. III. 44: suppl. Dec. 12.—Requires the treatment of shrubby or branching begonias, as in all regards but its technical botanical characters it is a begonia.

L. H. B.

HÍLLIA (Sir John Hill, 1716–1775, British botanist). *Rubiàceæ.* Shrubs of Trop. Amer., sometimes epiphytic, 2 of which are rarely grown as greenhouse or warmhouse evergreen subjects. Smooth, branches often rooting: lvs. opposite, simple, more or less fleshy: fls. large and rather showy, terminal and solitary, white and fragrant; corolla salverform, the tube long; stamens 4–7, inserted at the throat of the corolla: fr. a follicle.—Species about 10, W. Indies to S. Amer. **H. tetrándra,** Swartz. Plant 3–4 ft., the root bearing tubers: lvs. obovate to lanceolate, cuneate at base and rounded at top: lobes of corolla 4, roundish-obovate, not more than one-third length of tube. Mountains of Jamaica, Cuba; June in cult. B.M. 7355. *H. longiflòra,* Swartz, has elliptical pointed lvs., and 6–7 lanceolate bluntish reflexed corolla-lobes. W. Indies; apparently not now in the trade.

L. H. B.

HIMALAYA BERRY. The Himalaya berry is one of the evergreen blackberries of Asiatic origin. It is reported to have been introduced by Luther Burbank in the early nineties, the seed being received by him from an English traveler who secured it from the Himalaya Mountains. The vine is heavily thorned and a vigorous grower, making from 20 to 40 or 50 feet in a season and continues to grow until cold weather. It is of a trailing habit of growth, like the dewberry. The fruit begins to ripen in midsummer and gradually matures during a long period. As fruited in the Middle West, the berries are medium or below medium in size, decidedly tart unless dead ripe and with a more tender core than is usually found in the blackberry. The quality of the fruit is fair though not delicate in flavor. The fruit is of firm texture and on the Pacific coast it is reported as being a good shipper.

The Himalaya berry, like all of the evergreen blackberries, does not properly ripen its wood for winter and is not sufficiently hardy to be adapted for planting in the Upper Mississippi Valley and the other sections in which the winters are severe. Where covered with a heavy blanket of snow, the vines come through the winter in fair condition but in open winters they are completely killed back.

The Himalaya berry has been widely planted in the last three or four years, but it has not as yet established itself as a commercial berry in competition with several of the best standard varieties of blackberries with which it would be compared. See *Rubus.* A. T. Erwin.

HIMANTOGLÓSSUM: *Orchis.*

HIMANTOPHÝLLUM: *Imantophyllum=Clivia.*

HIPPEÁSTRUM (*knight* or *horse* and *star,* from some fancied resemblance in *H. equestre,* perhaps of the equitant leaves and the star-shaped corolla-opening). *Amaryllidàceæ.* Includes *Habránthus.* Showy bulbous plants, blooming in late winter to early summer; handled under glass in frosty climates. Some of them are frequently grown as spring- or summer-blooming house-plants.

Bulb tunicate: scape hollow: lvs. linear or strap-shaped: fls. large and showy, usually two to several being borne on a stout, leafless scape; perianth-tube evident, often long, dilated in the throat; segms. erect-spreading, nearly or quite equal; filaments (6) distinct, often with small scales between; throat of perianth often closed or provided with scales or a corona: fr. a loculicidally 3-valved caps.; seeds black, usually flattened or compressed.—From 60 to 70 Trop. American bulbous plants, much cult. and now much hybridized. Closely allied genera are Amaryllis (African), Crinum, Sprekelia, Brunsvigia, Zephyranthes, Lycoris, Sternbergia, Vallota. The genus divides itself into the narrow-lvd. (lvs. linear) and broad-lvd. sections. All the common garden sorts belong to the latter section. The species chiefly known in cult., or which have been parents of hybrid races, are contrasted in this account, although the kinds commonly seen are hybrids or derivatives. In some species the fls. precede the lvs.

The hippeastrums are usually known in gardens under the general name of amaryllis; and their culture is given in full under that name. Many of them are noble garden plants, but the high price of the bulbs prevents them from becoming popular. Most of the species were first described in the genus Amaryllis, but that genus differs in its solid scape and absence of scales between the filaments. Gardeners sometimes secure blooming plants in two years from seeds, by keeping the plants growing nearly continuously. The seeds are sown in flats and pricked off into small pots at the two-leaf stage. By the close of summer, they are shifted into 4- or 5-inch pots and grown through the winter. They go into about 6-inch pots when one year old, where they grow till the second winter, when they are then partially rested; in late winter, they begin active growth again, and can be brought into flower in spring.

Very many of the names in trade catalogues are of horticultural forms; and many of them cannot be referred positively to any of the original species. For the Belladonna lily, see *Amaryllis;* for Atamasco lily, see *Zephyranthes;* for Josephine lily, see *Brunsvigia.* For *Amaryllis aurea,* see *Lycoris;* for *A. candida,* see *Zephyranthes;* for *A. formossissima,* see *Sprekelia;* for *A. gigantea,* see *Brunsvigia;* for *A. longifolia,* see *Crinum;* for *A. lutea,* see *Sternbergia;* for *A. Nerine,* see *Nerine;* for *A. orientalis,* see *Brunsvigia* (*B. gigantea*); for *A. ornata,* see *Crinum;* for *A. speciosa* or *purpurea,* see *Vallota.* Following are Latin-form trade names, probably of hybrids: *atrosanguineum, cardinalis, crocea, delicata, formosa, Lindenii, macrantha, refulgens, rubis* (hybrid), *rubra striata, Williamsii.* Other trade names may be expected in the lists of dealers.

INDEX.

Ackermanni, 5.
acuminatum, 13.
Alberti, 10.
aulicum, 4.
citrinum, 13.
crocatum, 13.
equestre, 7.
Forgetii, 3.
fulgidum, 7, 13.
Gravinæ, 10.
ignescens, 7.
Johnsonii, 15.
Leopoldii, 11.
major, 7.
maranensis, 9.
miniatum, 13.
nudum, 9.
pardinum, 2.
platypetalum, 4.
procerum, 12.
psittacinum, 6.
pulcherrimum, 5
pulverulentum, 13.
pyrrochroum, 7.
Rayneri, 12.
Reginæ, 10.
reticulatum, 8.
Roezlii, 7.
rutilum, 13.
solandriflorum, 1.
spathaceum, 7.
Spectabile, 10.
splendens, 7.
striatifolium, 8.
stylosum, 9.
vittatum, 14.
Walteri, 7.

A. *Perianth-tube 4–5 in. long, very slender.*

1. **solandriflòrum,** Herb. Bulb ovoid, 3–4 in. diam., with a short neck: lvs. appearing with the fls., 1–2 ft. long, 1–2 in. wide, blunt: scape somewhat flattened, 2–3 ft. tall, bearing 2–4 declined greenish white fls.; perianth-tube cylindrical, nearly as long as the obovate sometimes purple-ribbed segms.; stamens not exserted. S. Amer. B.M. 2573; 3771. L.B.C. 12:1200. I.H. 35:58. —Little known in gardens, but the parent of hybrids.

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AA. *Perianth-tube short (usually not more than 1 in. long).*

B. *Throat constricted or closed by a neck or collar.*

C. *Stigma capitate.*

2. **pardìnum,** Dombr. Bulb globular, 2–3 in. diam., with a short neck: lvs. 5–7, appearing with the fls. but not fully developed until after the fls. are gone, becoming 2 ft. long and 2 in. broad, narrowed to the base: scape nearly terete, 1½ ft. tall, glaucous, usually bearing 2 spotted fls.; perianth-segms. 4–5 in. long, oblong but much narrowed at the base, acute, greenish yellow and much spotted with red, not striped, the lowest inner segm. narrowest; stamens declined, shorter than the perianth. Peru. B.M. 5645. G.W. 12, p. 654.—A handsome species, with fls. 6–7 in. across, offered in the trade, and also a parent in the modern spotted hybrids.

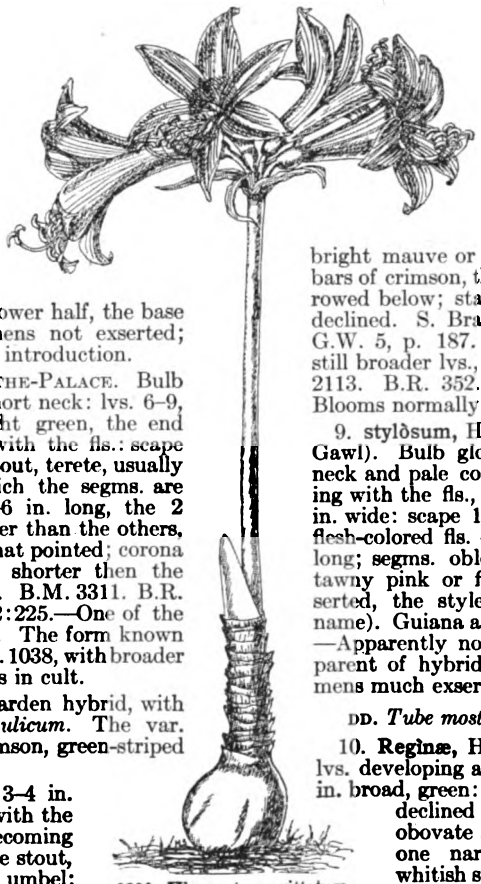
CC. *Stigma 3-parted.*

3. **Fórgetii,** Worsley. Differs from *H. pardinum* in the fls. being only partially striped, unspotted, and with narrower segms.: pedicels somewhat longer (about 3 in.); perianth dull crimson (color of *H. rutilum*), the segms. keeled in the lower half, the base green, about 6 in. across; stamens not exserted; stigma 3-lobed. Peru; a recent introduction.

4. **aùlicum,** Herb. LILY-OF-THE-PALACE. Bulb ovoid, 3–4 in. diam., with a short neck: lvs. 6–9, 1–2 ft. long, 2 in. broad, bright green, the end blunt or nearly so, appearing with the fls.: scape scarcely longer than the lvs., stout, terete, usually bearing 2 large red fls., of which the segms. are green at the base; segms. 5–6 in. long, the 2 upper inner ones much broader than the others, all of them obovate and somewhat pointed; corona in the throat green; stamens shorter than the perianth; filaments red. Brazil. B.M. 3311. B.R. 444. Gt. 45, p. 417. Gn.M. 2:225.—One of the best, and common in the trade. The form known as var. **platypétalum,** Lindl., B.R. 1038, with broader petals and more robust habit, is in cult.

5. **Áckermanni,** Hort., is a garden hybrid, with large crimson fls., near *H. aulicum*. The var. **pulchérrimum,** Hort., with crimson, green-striped fls., is best known.

6. **psittacìnum,** Herb. Bulb 3–4 in. diam., with a long neck: lvs. with the fls., 6–8, lightly glaucous, becoming nearly or quite 2 ft. long: scape stout, 2–3 ft. tall, bearing a 2–4-fld. umbel; perianth-segms. 4–5 in. long, oblong and acute, undulate, the edge crimson, the main part green but crimson-striped; stamens much shorter than the perianth. S. Brazil. B.R. 199. L.B.C. 13:1204.—Apparently little known in cult., but it has been a parent in hybridizations.



1839. Hippeastrum vittatum. (×⅙)

BB. *Throat not constricted.*

C. *Stigma capitate or only obscurely lobed.*

D. *Tube of perianth ½–1 in. long.*

7. **equéstre,** Herb. (*Amarýllis equéstris,* Ait.). BARBADOS LILY. Bulb globular, 2 in. diam., producing offsets freely, with brown scales and a short neck: lvs. 6–8, developing fully after the fls., 12–20 in. long and becoming about 2 in. wide, narrowed to the point: scape 1–2 ft., terete, glaucous; fls. 2–4, 4–5 in. across, the green tube 1 in. long, the segms. obovate-pointed, bright red with green at the base, the 3 inner ones narrower than the outer; stamens shorter than the perianth. Mex. to Chile and Brazil. B.M. 305. G.W. 9, p. 368.—An old garden species, one of the best for winter and spring blooming. There are several garden forms and hybrids, with larger and better fls. Var. **splèndens,** Truff., R. H. 1895:578 (var. *Wálleri,* Wittm., Gt. 44, 1418), is larger in all its parts, fls. red, and the pedicels are longer. Var. **fúlgidum,** Hort. (not *H. fúlgidum,* Herb.), has brilliant orange segms. margined with white. Var. **ignéscens,** Hort., is deep clear scarlet, with white throat and white bars on the segms. Var. **màjor,** Hort., has very large, bright orange fls., with a green central star. B.R. 234. *H. Roézlii,* Regel, *H. pyrróchroum,* Lem., I.H. 11:420, and *H. spathàceum,* Sims, B.M. 2315, are regarded by Baker as forms of this species. There are double-fld. forms.

8. **reticulàtum,** Herb. Bulb nearly globular, with a short neck: lvs. appearing with the fls., rather short and broad for the genus, being oblanceolate, 1 ft. long and 2 in. broad, thin, and bright green: scape about 1 ft. tall, nearly terete, bearing 3–6 tesselated or checkered fls. 4–5 in. across; fls. bright mauve or purple-red, with cross lines and bars of crimson, the segms. obovate and much narrowed below; stamens shorter than the perianth, declined. S. Brazil. B.M. 657. R.H. 1912:448. G.W. 5, p. 187. Var. **striatifòlium,** Baker, has still broader lvs., with a white keel or stripe. B.M. 2113. B.R. 352. G.C. III. 4:477.—Handsome. Blooms normally in late summer.

9. **stylòsum,** Herb. (*Amarýllis maranénsis,* Ker-Gawl). Bulb globular, 3 in. diam., with a short neck and pale coverings: lvs. 4–6, mostly appearing with the fls., bright green, becoming nearly 2 in. wide: scape 1–2 ft., bearing 3–8 light red or flesh-colored fls. 4 in. across; perianth-tube ½ in. long; segms. oblong-acute, less than 1 in. wide, tawny pink or flesh-red; stamens somewhat exserted, the style much so (whence the specific name). Guiana and Brazil. B.M. 2278. B.R. 719.—Apparently not much cult., but it has been a parent of hybrids. Var. **nùdum,** Worsley. Stamens much exserted and spreading.

DD. *Tube mostly very short (or scarcely any).*

10. **Reginæ,** Herb. Bulb globular, 3 in. diam.: lvs. developing after the fls., 2 ft. long and 1½–2 in. broad, green: scape 10–20 in., bearing 2–4 red declined fls.; perianth-segms. 4–5 in. long, obovate and acute, the lowest innermost one narrower, all bright red, a large whitish star in the throat; tube sometimes nearly or quite 1 in. long; stamens shorter than the perianth. Mex. to Peru and Brazil. B.M. 453.—An old garden plant, still much cult. There are double-fld. forms: *Amaryllis Alberti,* Lem., I.H. 13:498, Baker considers to be one of these. *H. Gravìnæ,* Melaz., is a hybrid resembling this species (*Amaryllis Graveana?*). G.W. 5, p. 187. *H. Spectábile,* Hort., is a hybrid near *H. Reginae.* L.B.C. 159.

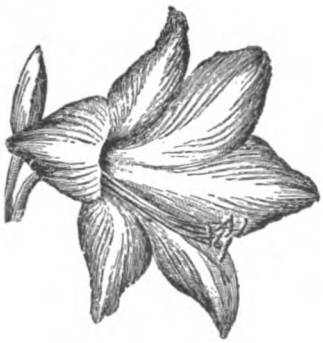
11. **Lèopoldii,** Dombr. Bulb globular, 2–3 in. diam., with short neck: lvs. with the fls. or nearly so, often 2 ft. long: scape stout, 1½–2 ft., nearly terete, bearing about 2 large, very regular and parti-colored fls., measuring 6–7 in. across; perianth-tube without any corona or constriction at the throat; segms. obovate, 2 in. broad, the lower half dull crimson, the tips greenish white, the intermediate part bright red, with a forked white mark at the base of each, and a green-white throat; stamens declined, mostly exceeding the perianth, the filaments white; style exserted. Peru. G.C. 1870:733. G.Z. 14:160.

12. **prócerum,** Lem. (*Amarýllis Ràyneri*, Hook. f.). Bulb ovoid, with a neck 10–12 in. long, on the apex of which—as on a trunk—the drooping, curling, buff-edged lvs. are borne (the lvs. 16–20 in. long): scape 12–18 in. high, 2-edged, green, bearing 2–3 horizontal pale lilac fls. 4–5 in. across; segms. oblanceolate, acute, not 1 in. broad; throat without a star; stamens much shorter than the perianth; stigma capitate. Brazil. I.H. 11:408. F.S. 20:2077, 2078. B.M. 5883. Gn. 45:350; 76, p. 93. G.C. III. 52: suppl. July 27. A.G. 22:713.—One of the most distinct of the genus. In the American trade. Sometimes called "blue amaryllis" and "empress of Brazil." Plant out for late summer or autumn bloom, in a warm, sunny place. Keep bulb dry until late spring.

cc. *Stigma markedly 3-parted.*

13. **rùtilum,** Herb. Bulb nearly globular, 2–3 in. diam., stoloniferous, with short neck: lvs. 6–8, elongating after flowering, bright green, 1 ft. long and an inch or more wide: scape as long as the lvs., somewhat compressed, glaucous, bearing 2–4 red fls.; perianth-tube ¾in. long, green, with a minute crown in the throat; segms. oblong, acute, crimson and green, keeled; stamens shorter than the perianth, the filaments red. Brazil. B.R. 23. L.B.C. 15:1449.—In cult. chiefly known in the var. **fúlgidum,** Baker (*H. fúlgidum*, Herb.), which is in all parts larger, deep crimson, the fl.-segms. 3–5 in. long. B.R. 226. B.M. 1943 (as *Amaryllis miniata*); 2475 (as *H. subbarbatum*). Var. **crocàtum,** Baker (*Amarýllis crocàta*) is as large as var. *fulgidum*, except in its fls., which are smaller, with undulate segms., saffron-colored. B.R. 38. Var. **citrìnum,** Baker, has bright yellow fls. Var. **acuminàtum,** Roem. (*A.* and *H. pulverulèntum*). Fls. pink and segms. acute. B.R. 534; 1188. L.B.C. 5:484. B.M. 2273.

14. **vittàtum,** Herb. Figs. 1839, 1840. Bulb globular, 3 in. diam.: lvs. 6–8, usually appearing after the fls., bright green, 2 ft. long: scape often 3 ft. high, bearing 3–6 horizontal or declined striped white-edged fls. 4–5-in. across; tube about 1 in. long, with an obscure crown or crest at the throat; segms. obovate-oblong and acute, 1½ in. or less broad, the under-color whitish but overlaid with red stripes, the keel white; stamens shorter than the limb. Peru; but once thought to be S. African. B.M. 129. G.C. III. 24:119.—The commonest species-type in American gardens, now cult. in many forms. It seems to have entered freely into hybrids, and some of the forms now passing as *H. vittatum* are perhaps mongrels. The double red feathery stripes on each side of the more or less irregular-edged segms. distinguish this species from its congeners.



1840. A flower of Hippeastrum vittatum. (×⅓)

15. **Jóhnsonii,** Bury. Fig. 1841. Fls. deep dull red, each segm. with a white stripe down the keel. A very profuse bloomer, and withstands much abuse. It is the most popular single amaryllid in this country, and is particularly prized for window-gardens. It is the oldest hybrid, having been raised by one Johnson, an English watchmaker, who, in 1799, crossed *H. Reginæ* with *H. vittatum*. Distinct and one of the best. Apparently not in American trade, but it has been used in hybridizing. G.W. 12, p. 653.

H. advenum, Herb. Belongs to the narrow-lvd. section of the genus: lvs. linear, glaucous: fls. 2–6, about 2 in. long, yellow or red, on slender pedicels, the segms. oblong-linear and acute; stigma 3-parted. Chile. B.M. 1125. B.R. 849.—A form with pale yellow fls. is var. *pállidus*, Herb. L.B.C. 18:1760.—*H. aulìctre*, Worsley. Garden hybrid of H. aulicum and H. equestre.—*H. iguapènse*, Wagn. Bulb small, ovate: lvs. lanceolate, 6–9 in. long and 2½ in. broad: scape about 6 in. high; fls. several, nodding, white with red or lilac stripes on upper segms. S. Brazil.—*H. Mándevillei*, Worsley. Hybrid, quaint and beautifully marked.—*H. pratènse*, Baker. Also linear-lvd.: fls. 2–4, bright scarlet, the very short tube with small scales in the throat, the segms. 2½ in. long; stigma capitate. Chile. B.R. 28:35.—*H. rùbrum*, Baker. Lvs. narrow-linear, glaucous, 1 ft. long, with the fls.: scape 6 in. high, bearing 1 or 2 small bright red fls.; stigma 3-parted. Chile.—*H. teretifólium*, C. H. Wright. Distinguished by nearly terete lvs.: fls. rosy pink, 2 in. long, campanulate, few in an umbel. Montevideo.

1841. Hippeastrum Johnsonii. (×⅓)

L. H. B.

HIPPOCRÈPIS, (from the Greek for *horse* and *shoe*, in reference to the shape of the pod). *Leguminòsæ*. Herbs, subshrubs or rarely shrubs, suitable for culture in the alpine garden.

Leaves impari-pinnate; lfts. entire, exstipellate; petioles rarely spinescent, persistent: fls. yellow, nodding, in racemes or axillary pedunculate spikes; ovary sessile, 1–2-ovuled; style filiform: pod flattened, indehiscent valves nearly horse-shoe-shaped.—Twelve species in Medit. region, Canary Isls., and 1 as far north as S. Scotland. Of easy cult. in ordinary garden soil. Prop. by division of the root or by seeds.

comòsa, Linn. Perennial, 8–24 in. high: st. herbaceous, prostrate: lfts. 7–11, obovate, obtuse: fls. yellow, in 4–8-fld. umbels. May–July. Cent. and S. Eu.—Grows on sunny slopes and prefers lime. L. H. B.

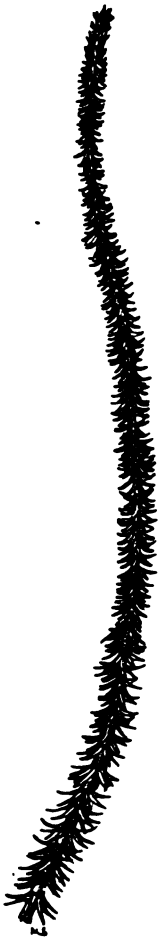
HIPPÓMANE (Greek, *horse-mania*, transferred from an ancient tree name). *Euphorbiàceæ*. A poisonous tropical tree, rarely cult. in European gardens. Juice milky: lvs. simple, alternate: fls. monœcious; staminate calyx 2–3-lobed, imbricate; ovules 1 in each of the 6–9 cells: fr. a drupe.—One species. Related to Sapium and Stillingia. The juice is poisonous internally and externally, though some persons seem to be immune. It was formerly supposed that even the shade of the tree was poisonous. It was used by the natives for arrow poison, and the like. Prop. by cuttings in sand with heat. The tree needs a sandy loam soil.

Mancinélla, Linn. MANCHINEEL. MANZANILLO. A much-branched tree, 20–40 ft., with thick naked twigs, terminated by the thick, smooth, broad-ovate, short-acuminate, minutely sharp-serrate, pear-like lvs. and thick spikes: fr. berry-like, about 1 in. thick. Coasts of Cent. Amer., W. Indies and adjoining S. Amer. and S. Fla. Gt. 15:510. J. B. S. NORTON.

HIPPÓPHAË (*Hippohaës*, ancient Greek name of a spiny plant, possibly derived from *hippos*, horse, and *pheos*, a spiny plant, probably *Poterium spinosum*). Also spelled *Hippophaës*. *Elæagnàceæ*. SEA BUCKTHORN. Ornamental woody plants grown for their silvery gray foliage and the brightly colored berries.

Deciduous shrubs or trees with spiny branches; the

young growth covered with silvery scales or stellate hairs: lvs. alternate, narrow: fls. dicœcious, from the axils of last year's branches in short racemes, the axis of which mostly develops into a branchlet or thorn in the pistillate plant, but is mostly deciduous in the staminate one; staminate fls. sessile, with 2 valvate sepals and usually 4 stamens with short filaments; pistillate fls. short-stalked; the 1-ovuled ovary inclosed by a receptacle bearing 2 minute sepals at its apex, style filiform with a cylindric stigma: fr. drupe-like, with a bony ovate stone.—Two species in Eu. and W. and C. Asia.



1842. Hippuris vulgaris. (×½)

The sea buckthorns are suckering shrubs or small trees with spreading usually spiny branches clothed with silvery gray narrow and rather small foliage, with insignificant yellow flowers appearing in spring before the leaves and followed in the pistillate plant by small but numerous bright orange-yellow berries persisting through the winter. The common sea buckthorn is perfectly hardy North, while the Himalayan species is tenderer and but rarely planted. The former inhabits the sandy banks of rivers and the seashore and also the steppes of central Asia. It grows well in almost any kind of soil including limestone and saline soil; in poor sandy soil it remains shrubby and spreads freely by suckers and has therefore been used successfully for the fixation of shifting-sand dunes; in better soil it grows into a small tree. It also is used sometimes for hedges in Europe. The pistillate plant is strikingly handsome in autumn when covered with its orange berries, which often are so numerous as to weigh down the branches. To insure a good setting of berries it is necessary to plant one or a few staminate plants with each group of pistillate ones; the staminate and pistillate plants may be distinguished even without flowers or fruits fairly well by their habit, the former being of more upright growth, while the pistillate ones are more spreading and twiggy. The berries are somewhat poisonous and but rarely eaten by birds. Propagation is by seeds sown at once or stratified, by cuttings of mature wood in spring, and also by root-cuttings, suckers and layers.

rhamnoìdes, Linn. Shrub or tree, occasionally to 30 ft.: branches gray, usually spiny: winter-buds golden brown: lvs. linear-lanceolate, short-petioled, obtusish, covered on both sides with silvery scales, at maturity above often glabrescent, ¾–2½ in. long: fls. appearing before the lvs., very small, yellowish: fr. subglobose or ovoid, orange-yellow, ¼–⅓in. long, ripening in Sept. Eu. through W. and Cent. Asia to the Altai, W. China and N. W. Himalayas. B.M. 8016. Gn. 49:62. G.M. 37:791. Gn.W. 21:110. J.H. III. 51:161. G.W. 15, p. 345. Var. **angustifòlia,** Loud., a form with pendulous branches and narrow lvs. Var. **procèra,** Rehd. Tree, to 50 ft.: young growth villous: lvs. oblong-lanceolate to lanceolate, with stellate hairs above, finally glabrous above. W. China.

H. salicifòlia, D. Don. Tree, to 40 ft.: lvs. lanceolate, acute, green above, white villous-tomentose beneath, 1½–4 in. long: fr. orange, ⅓in. long. Temp. Himalayas.

ALFRED REHDER.

HIPPÙRIS (*horse-tail* from the looks of the plant). *Haloragidàceæ.* Perennial aquatic herbs, one sometimes used in bog-gardening. Sts. simple: lvs. small, simple and entire, verticillate: fls. small and inconspicuous, perfect or polygamous, sessile in the axils; petals none; calyx entire; stamen 1; nearly or quite sessile, with the thread-shaped style lying between the 2 anther-lobes: fr. nut-like, 1-seeded.—Three species, very widely dispersed in temperate and frigid regions. **H. vulgàris,** Linn. (Fig. 1842), may be transferred to wet grounds and pools: to 2 ft. (or more in deep water): lvs. 6–12 in a whorl, acute, usually withered at the apex. In ponds and streams, Greenland, and Alaska to N. Y., New Mex., Calif.; also in Eu., Asia and in Patagonia.—It produces an attractive effect with the simple shoots standing above the water in ponds.

L. H. B.

HOBBLEBUSH: *Viburnum lantanoides.*

HODGSÒNIA (B. H. Hodgson, British scientist). *Cucurbitàceæ.* One species, a showy tendril-climbing shrub, in its native places in India sometimes extending 100 ft.; *H. macrocárpa,* Cogn. (*H. heteróclita,* Hook. f. & Thom.), hardly to be expected in cult. Lvs. coriaceous, 6–8 in. long, deeply 3–5-lobed, the lobes entire or slightly dentate: fls. dicœcious, white, tinged yellow within, the limb of the deeply 5-parted corolla bearing curling fringes 4 in. long; male fls. in long racemes, females solitary; calyx very long-tubular and slender; stamens 3, exserted; stigmas 3 and 2-fid, exserted: fr. berry-like, spherical, 4–10 in. across, red-brown and tomentose; seeds 2–3 in. long. F.S. 12:1262.—This odd and showy plant is said to require the conditions provided by a temperate greenhouse, although some report it as requiring hothouse treatment. L. H. B.

HOFFMÁNNIA (Georg Franz Hoffmann, 1760 or 1761–1826, professor of botany at Goettingen). Including *Campylóbotrys* and *Higginsia. Rubiàceæ.* Tropical American herbs or shrubs, with opposite or verticillate leaves and small white, yellow or red flowers, cultivated for the very showy foliage.

Branches either terete or 4-angled: lvs. simple: corolla tubular, with 4 (rarely 5) oblong or linear-obtuse lobes; stamens mostly 4; disk ring-like about the 2–3-loculed ovary or cushion-like; style filiform, the stigma 2-lobed: fr. an oblong or narrow many-seeded berry.—Species above 30, Cent. and S. Amer. The hoffmannias require warm temperature, although they may be plunged in the open in the summer. Well-grown specimens are also adapted to the decoration of window-gardens and living-rooms. Prop. by cuttings. Hoffmannias are very showy foliage plants.

1843. Hoffmannia discolor. A loose-growing sprig. (×⅓)

A. *Fl.-clusters on long stalks.*

díscolor, Hemsl. (*Campylóbotrys díscolor,* Hook.). Fig. 1843. About 6 in. high, but lopping over the side of the pot or pan and making a mat, slightly hairy, the branches purplish: lvs. short-petioled, oblong-obovate, entire, satiny green above and rich light purple to green beneath: fls. small, red, in recurving racemes, on red peduncles. Mex. B.M. 4530.—Excellent little plant.

refúlgens, Hemsl. Much like the former, but twice or more as large, the lvs. sessile and almost succulent, narrow-obovate, with many parallel veins running from the midrib to the margin, the under-surface pale red or wine-color and the upper surface dull green, with iridescent shades of purple and brown: fls. 1 in. across, pale red. Mex. B.M. 5346 (as *Higginsia refulgens*). H.F. II. 5:78.—A most beautiful plant.

AA. *Fl.-clusters crowded in the axils.*

Ghièsbreghtii, Hemsl. (*Campylóbotrys Ghièsbreghtii,* Lem.). Half-shrubby, 2–4 ft. tall, nearly glabrous: st. acutely 4-angled: lvs. usually 1 ft. or less long, oblong-lanceolate-acuminate, entire, the short winged petiole somewhat decurrent, very strongly veined, purple-red beneath and dark velvety green above: fls. yellow, with a red spot in the center. Mex. B.M. 5383 (as *Higginsia Ghiesbrechtii*). I.H. 8:279 (as Campylobotrys). G.W. 15, p. 330.—A form with handsomely mottled lvs. is var. **variegàta,** Hort. (I.H. 30:498).

regàlis, Hemsl. (*Campylóbotrys regàlis,* Lind.). Shrubby, strong-growing, glabrous, the branches obtusely 4-angled and somewhat fleshy: lvs. large, round-ovate and abruptly acuminate, entire, plicate with arched nerves, glabrous, purple-red beneath and dark rich green above: fls. yellow, sessile. Mex. B.M. 5280 (as Higginsia).

H. phœnicópoda, K. Schum. Lvs. ovate to oblong, violet-red beneath: fls. inconspicuous. Cent. Amer.

L. H. B.

HOFFMANSÉGGIA (Joh. Centurius, Count von Hoffmansegg, born 1766; wrote on plants of Portugal). *Leguminòsæ.* Thirty and more dwarf mostly glandular herbs and subshrubs from Kans. and Calif. to Patagonia, and in S. Afr., perhaps not cult.: lvs. bipinnate, with or without black glands: fls. yellow in naked racemes opposite the lvs. or terminal; petals 10 and nearly equal; stamens 10 and distinct: pod flat, oblong, sometimes falcate. The genus is allied to Cassia, from which it differs in its bipinnate rather than pinnate lvs., and to Cæsalpinia, which is distinguished by its prickles, woody stature, and other characteristics.

HOHENBÉRGIA (personal name). *Bromeliàceæ.* Interesting hothouse subjects grown in pots, closely allied to Æchmea.

Leaves forming a dense rosette, spiny-margined, often terminated with a stout spine: panicle on a tall scape, bi- or tripinnate, of short, dense, sessile or stipitate spikes; fls. sessile in the axils of large bracts, white or blue.—A Trop. American genus of about 20 species.

augústa, Mez (*Æchmèa augústa,* Baker. *Hoplophỳtum augústum,* Beer). Lvs. up to 3 ft. long and 3 in. broad, spiny, with pale scales on both sides: panicle pyramidal, much exceeding the lvs., floccose; fls. a little less than ½in. long, the petals blue. Brazil.

stellàta, Schult. (*Æchmèa glomeràta,* Hook.). Lvs. up to 3 ft. long, and 3 in. wide, marginal spines long: panicle interrupted, equaling or little exceeding the lvs.; fls. about 1 in. long, the petals blue. Trinidad and Brazil. B.M. 5668.

Legrelliàna, Baker (*Æchmèa Legrelliàna,* Mez. *Guzmània Legrelliàna,* Hort.). A strong billbergia-like plant, with 7–12 strong, entire, brown-scaly lvs. and a simple dense spike of red fls. standing 4–7 ft. high: floral bracts serrate. Uruguay.

GEORGE V. NASH.

HOHÈRIA (from the New Zeal. vernacular name *hoheri*). *Malvàceæ.* Small trees or shrubs native to New Zeal.: lvs. variable, alternate, serrate, petiolate: fls. numerous, white, in axillary fascicles; peduncles jointed at the middle; bracteoles wanting; calyx hemispherical, 5-toothed; petals oblique, notched near the apex; staminal column split at the top into numerous filaments, usually arranged in 5 bundles: fruiting carpels 5, indehiscent, furnished with a broad membranous wing at the back.—Three or 4 species; by some regarded as one variable species. *H. populnea,* A. Cunn. A small, handsome tree, 10–30 ft., glabrous except the young shoots, peduncles and calyxes, which are more or less pubescent: lvs. very variable, especially in young plants: fls. snow-white, produced in great profusion: carpels produced outward and upward into a membranous wing, longer than broad. G.C. III. 30:384; 52:355. Gn. 62, p. 309; 76, p. 580. Scarcely cult.

HOIBRÉNKIA: *Staphylea.*

HOLBOÈLLIA (Frederick Louis Holboell, once Superintendent of Botanical Garden, Copenhagen). *Lardizabalàceæ.* Ornamental vines grown chiefly for their handsome evergreen digitate foliage.

Twining shrubs: lvs. coriaceous, long-petioled, digitate, with 3–9 stalked entire lfts.: fls. monœcious, in few-fld. racemes; sepals 6, petal-like, obtusish, fleshy; between the sepals and the 6 free stamens 6 small nectaries sometimes called petals; the staminate fls. with rudimentary ovaries; the pistillate with small stamens and 3 distinct carpels developing into 1–3 large oblong pods with numerous black seeds.—Five species in China and Himalayas.

The holboellias are quick-growing evergreen vines very similar in foliage to *Akebia quinata* but the flowers are quite different; they are either white or the pistillate are purplish and the staminate which are borne in separate racemes whitish or greenish white; they appear with the young leaves in spring and are not showy, but the large purple pods are conspicuous. None of the species is hardy North, but the plants should be tried outdoors in the South where an evergreen quick-growing climber is desired, as they make annual shoots 10 to 12 feet long, and the foliage is distinct and beautiful. For the cool greenhouse they are too rampant and produce too few flowers. Propagation is by seeds which germinate readily; also by layers and by softwood cuttings. For further cultural notes, see *Stauntonia.*

coriàcea, Diels. Lfts. always 3, coriaceous, ovate to oblong-lanceolate or narrow-oblong, acute, rounded or broadly cuneate at the base, light green below with the veinlets not visible, 2–3½ in. long: fls. ⅛–½in. long; the staminate whitish, on pedicels about 1 in. long, the pistillate purplish on pedicels to 2 in. long. Cent. China.

latifòlia, Wall. Lfts. 3–7, ovate-oblong to elliptic-oblong, acuminate, pale green below and reticulate, 2½–3½ in. long: fls. about ½in. long, in short-peduncled racemes, on pedicels ¼–½in. long; the pistillate purple, the staminate greenish white, fragrant: fr. consisting usually of 2 oblong carpels, each about 4 in. long and 2 in. thick, rosy purple, edible. Himalayas. B.R. 32:49. J.F. 2:144. R.H. 1890:348. Gn. 8, p. 548; 14, p. 369.

H. cunèata, Oliver=Sargentodoxa cuneata.—*H. Fárgesii,* Réaubourg. Lfts. 5–9, usually oblong-lanceolate, glaucescent below: fls. ¾in. long, purplish and greenish white. Cent. China.—*H. grandiflòra,* Réaubourg. Lfts. 5–7, usually lanceolate, reticulate and grayish green below: fls. nearly 1 in. long, waxy white. W. China.

ALFRED REHDER.

HÓLCUS (Latin name for a kind of grass, from *holkós,* attractive). *Gramineæ.* This genus, named Holcus by Linnæus, was called Sorgum by Adanson (*Sorghum,* Moench). The name Holcus was accepted by some botanists while by others the genus was united with

LV. Hollyhock.

Andropogon. It seems best, however, to restore the Linnæan name. They are important fodder grasses.

The genus differs from Andropogon in having spikelets in 3's in an open or contracted panicle. The various cult. varieties known as sorghum or sorgo, broomcorn, Jerusalem corn, milo maize or milo, durra, and so on, are considered by some botanists to have been derived from the wild species, *H. halepénsis*, Linn. (*Andropògon halepénsis*, Brot. *Sórghum halépense*, Pers.). Others maintain these cult. forms as varieties of a distinct species, *H. Sórghum*, Linn. (*Andropògon Sórghum*, Brot. *Sórghum vulgàre*, Pers.). The cult. forms are annuals, with tall jointed sts. bearing large terminal panicles. Depending upon their uses, they fall naturally into 3 groups: (1) Broom-corn, in which the branches of the panicle are elongated and are thus adapted to the manufacture of brooms; (2) the sugar or saccharine sorghums, having loose panicles, with drooping branches and red-brown spikelets, cult. for the sweet juice and for forage. Amber and Orange are leading forms of sugar sorghum. (3) The remaining varieties are grouped together as non-saccharine sorghums. They are grown for forage and for the seed. Gn. 4, p. 83 (as *S. bicolor*). The common forms grown in this country and offered in the trade are: Kafir corn, with sts. 4–5 ft. high, stocky growth, and dense, upright panicles; milo or milo maize, or African millet, similar but about twice as tall; durra (variously spelled doura, dhoura, and so on), including Egyptian rice corn, and Guinea corn, with compact panicles on an often recurved stalk. The wild species, *H. halepensis*, Linn., JOHNSON-GRASS, has a large open panicle of smaller spikelets. Gn. 13, p. 305. Dept. Agric., Div. Agrost. 14:12.—It is a perennial, spreading by stout rhizomes and very difficult to eradicate from cult. ground. For history of sorghums see Dept. Agric. Bur. Pl. Ind. Bull. No. 175 (1910) and Bur. Pl. Ind. Circ. No. 50 (1910). Sudan-grass and Tunis-grass are varieties of sorghum that resemble Johnson-grass in aspect but are annuals devoid of rootstocks. They have recently been intro. in the U. S. and give promise of value as forage plants in the southern states. See "Some New Grasses for the South," Yearbook U. S. Dept. Agric., 1912.

H. lanàtus=Notholcus lanatus.

A. S. HITCHCOCK.

HOLLY: *Ilex*.

HOLLYHOCK (*Althæa rosea*, which see). Figs. 1844, 1845. The hollyhock is one of the very oldest of cultivated flowers and is today an inhabitant of most gardens, and is known by its common name not only to all cultivators of plants but even to school-children. Its showy blossoms in July after the larger number of plants have ceased flowering has much helped to make it known to all, while its history, its place in poetry and folk-lore, and its associations in the past drama of the world have been forgotten or vaguely remembered. Its beauty causes its cultivation today.

The hollyhock is a native of China, botanically described as a biennial and evidently a cultivated plant in China when first brought to the attention of European cultivators, since it is said to have been "of many colors and forms." Very probably its colors in a wild state, as now often seen in mixed retrograde seedlings, were rose-pink tending to red and white. The real reds and the present deep maroon shades would naturally be obtained rather easily by selection. The yellow color is, in the opinion of some, a much later acquired one, and the least liable to come true from seed.

The doubleness of the flower has undoubtedly been an acquired character under cultivation. The hollyhock has been propagated almost entirely from selected seed for so many years that both in color and doubleness it comes true from seed which has not been cross-fertilized with other colors or forms.

The bees delight in the plentiful pollen of the hollyhock so that in a mixed group of plants the seed will be indiscriminately crossed, and naturally a few poor single-flowered plants may affect the seed from a whole group. The color of the flower is, however, much influenced by the seed-bearing parent. The pollen on the hollyhock is so plentiful that the bee soon gets a load and goes home, in many cases not having visited more than one plant. For this reason a short distance between groups, especially if separated by some barrier, very much prevents cross-fertilization. Purchased seed comes about 75 per cent true to color and possibly 40 per cent fairly double.

1844. The hollyhock.

The hollyhock, while called in botanical history a biennial, is at least a short-lived perennial. Its heavy type of root with very short stolons or rather side crown-buds at the head of the root-system would naturally lead to its description as a biennial. It belongs, because of its root-system, to a horticultural class of plants, which, while truly perennial under proper conditions become biennial or even annual under other circumstances. Other plants having very similar root-formations are the dandelion, digitalis, aquilegia, platycodon and delphinium. These are more or less short-lived perennials since their permanency depends on the preservation of an easily destroyed crown-bud or rather the head of the root-system. Heaving of the plant by frost exposes the main root-stem below the side buds and causes the plant to die after flowering. In like manner the removal of soil from about the plants, as by rains, shortens the life by exposing the root below its natural level with the soil. The seed of the hollyhock, as well as the other genera mentioned with this root-system, germinate very quickly —five to ten days.

Hollyhock seeds sown in the greenhouse or frame during March or earlier and given plenty of root-room will flower the first year from seed although somewhat later than established plants. Plants grown as above in pots are likely to show less perennial character of the root and are more liable to disease. The seed should be sown outdoors during June or July in soil with sufficient clay and surface soil-water to cause the seedlings to form a system of strong side tap-roots, rather than one or two main roots as will occur in too sandy or dry soil, or on the other hand too many fibrous surface-roots as when grown in pots or in a too-wet soil.

Plants from outdoor spring- or early summer-sown seed should be moved to their permanent positions early the following spring, care being taken to dig the plant with all the main roots, and in planting to place these roots in a natural position, i.e., pointing downward. The crown of the plant should be a little below the surface of the ground (this is important). Fall planting, with the heaving by frost, especially of tap-rooted

plants, means replanting in the spring to the proper depth or the usual loss of the plant after one year's bloom.

Hollyhocks may be propagated in the spring by placing a plant in sand so as to cover the crown of the root which will cause a number of suckers to be sent up about the crown, which may be removed and rooted.

The hollyhock rust (*Puccinia malvacærum*) bothers very little in deeply dug and drained beds with plants grown outdoors and planted with the tap-roots properly

1845. Semi-double hollyhock. (×½)

placed and the crowns in the proper place in reference to the soil-surface. An appreciation of the deep-rooting, drainage-liking habit and qualifications of the plant will do more to combat this disease than any amount of bordeaux mixture. In the United States Experiment Station Record, Vol. XXXI, No. 3, note is made from an article in a French publication (Compt. Rend. Acad. Sci. 158, No. 6) which declares the hollyhock rust to have been successfully combated during a three-year trial by supplying as water to the roots a 3 per cent solution of copper sulfate.

In landscape work, the hollyhock best belongs to the herbaceous perennial groupings, but it can be well used alone in groups adjoining shrubbery, or in many places in place of shrubbery. It can seldom be used to advantage in mixture with woody plants, since the hollyhock needs light on its lower basal leaves. Further, the foliage of the hollyhock neither resembles nor contrasts well with that of the larger number of shrubs, although there are exceptions, for example, hydrangeas of the arborescens type and hollyhocks form a pleasing mixture.

F. W. Barclay.

HOLLY, SEA: *Eryngium.*

HOLMSKIÒLDIA (Theodor Holmskiold, 1732–1794, Danish nobleman and scientist). *Verbenàceæ.* Shrubs, one of which is offered, suitable for growing under glass.

Leaves opposite, entire or dentate: fls. racemose or cymose; calyx membranaceous and colored; corolla cylindric and curved, the oblique limb with 5 short lobes; stamens 4, didynamous, the anthers exserted: fr. an obovoid drupe, 4-lobed, included in the enlarged calyx. Probably 3 species, African and Asian. **H. sanguínea,** Retz., is a straggling shrub 10–30 ft. high, in the subtropical Himalayan region: lvs. 3 in. long, ovate, acuminate, entire or toothed: corolla 1 in. long, brick-red to orange: drupe ½in. or less long, the calyx 1 in. diam. Offered abroad; an evergreen shrub.

L. H. B.

HOLODÍSCUS (Greek *holos,* entire, and *discos;* the disk is entire). Syn., *Schizonòtus, Sericothèca. Rosàceæ.* Ornamental shrubs, cultivated for the showy panicles of creamy white flowers.

Deciduous, more or less pubescent: lvs. alternate, petioled, without stipules, incisely serrate or pinnately lobed: fls. in terminal panicles, perfect; calyx cup-shaped, 5-lobed; petals 5; stamens about 20; ovaries 5, surrounded by an entire disk, developing into 5 distinct, pubescent, 1-seeded achenes. Formerly usually referred to Spiræa, but more nearly related to Exochorda.—About 14 closely related species ranging from Brit. Col. through Mex. to Colombia, and east to Idaho, Colo. and New Mex., have been distinguished; by some botanists they are reduced to 5 or even to only 2 species.

These are ornamental free-flowering shrubs with rather small dull green foliage and small, whitish flowers in ample showy panicles: fruit insignificant. *H. discolor* is a very graceful plant, with its drooping feathery panicles of creamy white flowers, and well adapted for borders of shrubberies or for single specimens on the lawn; it is hardy in favorable localities as far north as Massachusetts. They grow in almost any well-drained soil, and do best in a sunny position. Propagation is by seeds usually sown in boxes in fall and only slightly covered with soil, or by layers; sometimes also increased by greenwood cuttings under glass taken with a heel, but usually only a small percentage of them take root.

díscolor, Maxim. (*Spiræa discolor,* Pursh. *Sericothèca discolor,* Rydb.). Fig. 1846. Shrub, to 20 ft., with slender, arching branches: lvs. ovate or oblong, truncate or narrowed at the base, pinnately lobed, lobes dentate or nearly entire, usually glabrous above, pubescent or tomentose beneath, ½–3 in. long: fls. creamy white, small, in ample drooping panicles 3–9 in. long. July. Brit. Col. to Calif., east to Idaho and Mont. Gn. 45, p. 56; 47, p. 188; 49, p. 104; 50, p. 278; 63, p. 195; 74, p. 41; 76, p. 556. G.C. III. 25:21; 32: suppl. Oct. 11. G.W. 8, p. 302. G.F. 4:617. G. 25: 363. B.R. 1365. R.H. 1906, p. 440.—The typical form has the lvs. whitish tomentose below; var. **ariæfòlius,** Aschers. & Graebn. (*Spiræa ariæfòlia,* Sm.), which is the commonly cult. form, has the lvs. grayish green and pubescent below.

dumòsus, Heller (*H. discolor* var. *dumòsus,* Dipp. *Spiræa dumòsa,* Nutt. *H. austràlis,* Heller). Erect shrub, 8 ft. high: lvs. obovate, acute or obtuse, cuneate at the base, coarsely toothed, pubescent above, whitish-tomentose beneath, 1–2 in. long: panicle ovoid or conic, 2–7 in. long, with ascending or spreading branches. Wyo. and Utah to New Mex. and Mex. Bull. Torrey Bot. Club. 25:338.

H. Boursièri, Rehd. (Spiræa Boursieri, Carr. Sericotheca Boursieri, Rydb.). Allied to H. dumosus, but lvs. flabellate or roundish, smaller and infl. usually simple or sparingly branched, 2–3 in. long. Calif. R.H. 1859, p. 519.

Alfred Rehder.

1846. Holodiscus discolor. (×½)

HÒLOTHRIX (from the Greek for *whole* and *hair;* in reference to the st. being covered with hairs). *Orchidàceæ.* A group of 50–60 species of terrestrial orchids from S. Afr. and Madagascar. Lvs. 1 or 2, sessile, ovate or orbicular-reniform, radical: scapes slender, usually hairy and without sheaths; fls. small, in slender, usually secund spikes; sepals connivent, sometimes hairy; petals smaller and longer, entire or variously divided at the apex; lip erect or spreading, adnate to the base of the column; column very short, usually auricled at the sides of the stigma: caps. ovoid or oblong. These plants require the temperature of a warm greenhouse and thrive in a mixture of peat, sphagnum and charcoal. *H. villòsa,* Lindl. Lvs. round, fleshy, hairy, borne close to the surface of the soil: infl. about 9 in. high; fls. about 30, small, yellowish green, slightly fragrant. S. Afr.

HOMALÁNTHUS (Greek *homalos,* like, and *anthos,* flower). *Euphorbiàceæ.* Tropical trees, sometimes cultivated in warmer regions or in greenhouses for the foliage.

Juice milky: lvs. simple, alternate, petioled, entire, glabrous, usually triangular-ovate: fls. apetalous, inconspicuous, in terminal racemes, the pistillate at the base; staminate calyx of 1–2 sepals, stamens 5–50: ovules 1 in each of the 2–3 cells.—Nineteen species distributed from S. E. Asia and Pacific islands to Austral. Related to Sapium and Stillingia. Some species closely resemble species of Sapium in foliage and habit. Sometimes spelled Omalanthus. The cult. and propagation are about the same as for the tree-like euphorbias.

populifòlius, Graham (*Carúmbium populifòlium,* Benth.) QUEENSLAND POPLAR. Lvs. 2–4 or more in. long and as wide, slender petioled, glaucous, copper-colored when young, rarely subpeltate: racemes slender, 3–4 in. long; sepals of staminate fls. 2; stamens 5–6; stigmas without glands. Austral. B.M. 2780.

H. populneus, Pax=H. Leschenaultianus, Juss., of Malay region, sometimes confused with H. populifolius but separated by Pax on the glandular stigmas, may be in cult.; as also the following: *H. fatuòsus,* Vill. Lvs. peltate. Gt. 15:504.—*H. gigantèus,* Zoll. Monosepalous, stamens 10–20.—*H. polyándrus,* Cheesem. Monosepalous, stamens 40–50.

J. B. S. NORTON.

HOMALOMÈNA (Greek, variously explained). Also written *Homalonema. Aràceæ.* Tender foliage plants, variegated after the fashion of the well-known dieffenbachias, and the rarer aglaonema and schismatoglottis.

Robust herbs, with a thick rhizome: st. short or none: lvs. ovate- or triangular-cordate, or lanceolate, nerves reaching the margin; petiole mostly long and sheathing: stamens distinct: fr. included within the persistent spathe; ovules anatropous, adnate to the septa.—About 80 species, natives of Trop. Asia and Amer. It is probable that the plants seldom produce fls. or fr. in cult. They are known to the trade as Curmeria, which is now regarded as a section of Homalomena, in which the spathe has a distinct tube and the lvs. are either glabrous or pilose, while in the section Euhomalomena the spathe has an indistinct tube, and the lvs. are always glabrous. For cult., see *Dieffenbachia.* Latest Monograph by Engler in Das Pflanzenreich, hft. 55. 1912. The species described below belong to the subgenus Curmeria, with 4 other species, American; the other species are Asian and of Pacific islands.

A. *Lvs. irregularly blotched.*

Wállisii, Regel (*Curmèria Wállisii,* Mast.). Fig. 1847. Lvs. glabrous throughout, the base obtuse or acute, not notched; petiole 1½ in. long; blade 5 in. long, 2–2½ in. wide. Colombia. G.C. II. 7:108. B.M. 6571 (midrib outlined in light color). I.H. 25:303. R.H. 1878, p. 193.—The blotches are pale yellowish green, becoming greenish gray. None of these pictures shows a white-bordered lf. with golden blotches, as one dealer advertises.

AA. *Lvs. with midrib bordered with white.*

picturàta, Regel (*Curmèria picturàta,* Lind. & André). Lvs. with petiole and midrib pilose; petiole 4 in. long; blade 10–12 in. long, 8 in. wide. Colombia. I.H. 20:121.—Blotched only near the midrib.

WILHELM MILLER.

HOMÈRIA (said to be from *homereo,* alluding to the *meeting* or *joining* of the filaments). *Iridàceæ.* Half-hardy bulbs that can be set out in spring, and bear orange-colored or red flowers in summer.

It is an endemic Cape genus of about 6 species: st. erect from a tunicated corm, producing 1 or more

1847. Homalomena Wallisii.

peduncles above: developed lf. usually 1, linear, surpassing the st.: fls. in one or few clusters, successive and fugaceous; perianth funnelform, very deeply cut, the segms. narrow and nearly equal or sometimes the 3 inner ones narrower; stamens united by their filaments into a column: fr. a clavate caps.—Homeria is allied to Sparaxis, requires the same cult., and the bulbs are dormant from Aug. to Nov. It belongs to the Moræa tribe, in which the fls. are stalked and more than 1 to a spathe, and the style-branches placed opposite the stamens. It differs from Iris and Moræa in having style-branches furnished with terminal stigmas not overtopping the anthers. Nearer allies of garden value are Tigridia, Herbertia and Ferraria, from all of which it differs in the 2 petaloid stigmatose crests at the ends of the style-branches.

collìna, Vent. (*Moræa collìna,* Thunb.). Corm globose, ¾–1 in. diam.: lf. linear, rigid, 1½–2 ft. long, overtopping the fls.: st. bearing 1–4 clusters of fls.; perianth-limb 1¼–1½ in. long, typically bright red, as in B.M. 1033; G.C. III. 4:163; 50:476. Var. **aurantìaca,** Baker, has a slenderer habit and yellow-clawed, bright red segms. which are narrower and more acute than the type. B.M. 1612. Var. **ochroleùca,** Baker, has the habit of the type and pale yellow fls. B.M. 1103.

The other species of Homeria are as follows: *H. élegans,* Sweet. Outer segms. tawny, the others or sometimes all 6 yellow, the 3 outer with large green or yellow-brown blotch in middle.—*H. linedta,* Sweet. Fls. copper-red, with small yellow-dotted blotch at base inside.—*H. maculàta,* Klatt. Fls. yellow, the segms. with a greenish claw and greenish blotch above the base.—*H. minedta,* Sweet. Fls. tawny or fulvous-red throughout.—*H. pállida,* Baker. Fls. pale yellow.

L. H. B.

HOMOCÊLTIS: *Aphananthe.*

HOMÓGYNE (from *homos,* similar, and *gyne,* female, because of similarity of male and female fls.). *Compósitæ.* A small and little-known group of hardy perennials grown for their attractive white or purple heads of showy flowers.

Leaves more or less white-woolly, radical broad,

cordate or sometimes sinuate-dentate, usually smaller than those in Tussilago and Petasites, to which the genus is related: scapes 1-2-headed, usually all of disk-fls.: achenes linear, 5-10-ribbed.—There are only 3 known species, all from the mountains of Cent. Eu., and they prefer moist garden borders in cult. Prop. by division in spring. Perhaps not in cult. in Amer.

alpina, Cass. (*Tussilàgo alpìna,* Linn.). About 6 in., the st. simple: the lower lvs. cordate-reniform, those of the st. ovate-lanceolate, the radical ones withering before flowering time: fls. in solitary heads, terminating the st., all discoid, light purple. B.M. 84 (as *Tussilago alpina*).—Perhaps better treated as a partial alpine. N. TAYLOR.

HONCKÉNYA (named after G. A. Honckeny, 1724–1805, author of a flora of Germany). *Tiliàceæ.* Trees or shrubs covered with stellate pubescence: lvs. entire or lobed: fls. large, blue-violet, showy, in terminal racemes; calyx of 4–5 sepals; petals 4–5, glandless at the base: caps. oblong, loculicidally 4–8-valved; seeds numerous, horizontal, compressed.—Two or 3 species in Trop. W. Afr. *H. ficifòlia,* Willd., is offered abroad. Shrub, with purplish branches: lvs. cordate, roundish or oblong, more or less deeply 3–7-lobed: fls. numerous, in terminal racemose cymes; sepals 3–5, oblong; petals roundish, stalked; ovary 4–8-celled, with numerous ovules in each cell: caps. 1–2 in. long; valves covered with numerous, spreading ciliated bristles, each terminated by a small, white deciduous point. Guinea. B.M. 7836. —A handsome-fld. shrub. Prop. by cuttings of young wood inserted in sand under glass with bottom heat. Thrives in a mixture of loam and peat. L. H. B.

HONESTY: *Lunaria annua.*

HONEY LOCUST: *Gleditsia triacanthos.* **Honeysuckle:** *Lonicera.* **Honeywort:** *Cerinthe.*

HOÒDIA (from a personal name). *Asclepiadàceæ.* Stout low perennial succulents of Trop. and S. Afr., sometimes seen in choice amateur collections; species about 10 or 12: allied to Huernia and Stapelia: plant usually branched, with spine-tipped tubercles, cactus-like: fls. large and showy, solitary or in small clusters, springing from the grooves toward the top of the st., yellowish, purplish or tawny; limb of corolla entire or slightly 5-lobed, the lobes subulate-pointed; corona double, arising from the staminal column, each part of 5 lobes. Require greenhouse treatment, probably similar to related genera. L. H. B.

HOÒKERA: *Brodiæa.*

HOP: *Humulus.* **Hop Hornbeam:** *Ostrya.* **Hop, Wild:** *Bryonia dioica.*

HOPLOPHŸTUM. Several bromeliads have been described under this name, but the species are now referred to *Æchmea. Halophytum* of one trade catalogue is apparently an error for *Hoplophytum.*

HÓRDEUM (an ancient Latin name for barley). *Gramineæ.* Annual or perennial grasses with terminal bristly spikes.

Spikelets 1-fld., 3 together at each joint of the rachis, the middle one sessile and perfect, the lateral usually pedicelled, often reduced to awns: the rachis breaking up at maturity into single joints with the cluster of spikelets attached.—Species about 16, temperate regions of both hemispheres. Elymus, some species of which resemble Hordeum, differs in having 2 developed, several-fld. spikelets at each node. Hordeum includes the cult. barley (*H. vulgare,* Linn.) and several troublesome weeds. Among the latter may be mentioned, *H. murinum,* Linn., called WILD BARLEY, BARLEY-GRASS and FOXTAIL on the Pacific slope; *H. nodosum,* Linn., common throughout the U. S., and *H. jubatum,* Linn. SQUIRREL-TAIL GRASS, called FOX-TAIL in Wyo. and TICKLE-GRASS in Nev. The first two are annual. The last, a perennial, is also cult. for ornament.

jubàtum, Linn. SQUIRREL-TAIL GRASS. WILD BARLEY. Erect, simple, usually smooth and glabrous, 10 in. to 2 ft. high: lvs. 1–5 in. long: only the central spikelet in each cluster perfect; awns of empty glumes 1–2½ in. long, spreading. In dry soil, N. U. S. and Canada. B.B. 1:229. Dept. Agric., Div. Agrost. 17:307.—Sometimes cult. for ornament on account of the feathery heads. A. S. HITCHCOCK.

HOREHOUND: *Marrubium.*

HORMÌNUM (old Greek name for sage). *Labiàtæ.* One herbaceous perennial, **H. pyrenàicum,** Linn., adapted to borders and rock-gardens: sts. simple and nearly leafless: lvs. mostly radical, ovate, toothed or crenate, the floral lvs. reduced to bracts: fls. medium size, purple-violet, nodding, in secund verticils or whorls; calyx campanulate, 2-lipped, about 13-nerved; corolla-tube exserted, the limb somewhat 2-lipped, the upper lip truncate-emarginate, the lower or anterior 3-parted; stamens 4, didynamous; style 2-lobed: nutlets ovoid. The plant grows 8–12 in. high; Pyrenees to the Tyrol; it makes a tuft of foliage; blooms in midsummer; hardy in England. Vars. *álbum* and *grandiflòrum purpùreum* are offered. Other plants sometimes referred to Horminum are properly salvias. L. H. B.

HORNBEAM: *Carpinus.*

HORNED POPPY: *Glaucium.*

HORSE, in combination with other names of plants, usually signifies something large and coarse, not necessarily eaten by horses.

HORSE BALM: *Collinsonia.* **Horse Bean:** *Vicia Faba.* **Horse-Chestnut:** *Æsculus.* **Horse Mint:** *Monarda.* **Horse-radish Tree:** *Moringa pterygosperma.* **Horse Sugar:** *Symplocos tinctoria.* **Horse-tail:** *Equisetum.* **Horseweed:** *Collinsonia.*

HORSE-RADISH (Fig. 1848), the well-known condiment used so much with roast beef and oysters, is a member of the natural family Cruciferæ, to which belong cabbage, turnip, wallflower, stock, charlock, mustard, and many other vegetables, flowers and weeds. It comes to us from Great Britain, where it is thought to have been naturalized from some more eastern European country. It is often found growing wild in moist locations, such as the margins of streams, in cool woods and damp meadows, and, in some places, notably in the state of New York, is troublesome as a weed.

1848. Good root of horse-radish.

The root is perennial, fleshy, whitish externally, pure white within, conical at the top, cylindrical, and, unlike the tap-roots of parsnips, is abruptly branched below. When bruised, it emits a volatile oil of strong, pungent odor and hot, biting taste. If eaten before this oil evaporates, it "is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally, it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion; but it is also occasionally employed in medicine." (U. S. Dispensatory.) As a table relish, the consumption of horse-radish is increasing, and greater attention is being paid to its cultivation than formerly. Under the old methods

profitable returns were often secured, but under the new, profits are generally highly satisfactory where enemies are not very troublesome. The season of fresh-grated horse-radish runs almost parallel to that of oysters, with which the root is most frequently eaten in this country. Ungrated roots are, however, kept in cold storage for summer use, since roots dug at that season have an unpleasant taste.

Horse-radish will do well upon almost any soil except the lightest sand and the heaviest clay, but a deep loam of medium texture and moderate richness, well supplied with humus and moisture, will produce roots of the best quality and the largest size. In dry soils the roots will be small, woody and deficient in pungency; in wet soils, small, succulent, strong-tasting. Drainage is essential, and so is a fairly open subsoil. Hard subsoil induces excessive branching of the root. Applications of nitrogenous manures should be rather light, commercial fertilizers rich in potash being given the preference. Rolfs recommends a mixture containing 10 per cent potash, 7 per cent phosphoric acid, 4 per cent nitrogen, 600 pounds drilled in to the acre. A heavier application broadcast and deeply plowed under, it is thought, would give better results, since the shaft of the root is less likely to become unduly branched when the food is below instead of above and around it, especially when the sets are placed horizontally. A weeder should be used after the harrow periodically until the plants are an inch or so tall. Thorough preparation of the soil is essential.

1849. Root-cuttings of horse-radish. (×⅓)

Since horse-radish rarely produces seeds, cuttings are made from the roots not less than ¼ inch thick and 4 to 5 inches long (Fig. 1849). To facilitate planting the large end up, the upper end is cut off square and the lower oblique. If set small end up, no growth may result. In horizontal planting this special cutting is unnecessary. Root-crowns are sometimes used, but since these develop a large number of roots too small for profitable grating, they are employed only for increasing stock.

The land having been prepared, shallow furrows are laid off 30 inches apart and 2 to 5 inches deep, according to the method of planting. Sets are planted horizontally, vertically, and at all intervening angles, the large ends being made to point in one direction to facilitate cultivation and digging. The angle is a matter of choice, good returns being secured in each. The usual distance between sets is about 12 inches. Cultivation is given after every rain, or once in ten days, until the leaves shade the ground.

Double-cropping is common in horse-radish growing, early cabbage, turnip beets and other quick-maturing plants being used. The sets are dibbled in two to four weeks after the first crop, vertically, 18 inches asunder, between the rows of cabbage, which are not less than 2 feet apart. One management answers for both crops until the first is removed, when, after one cultivation, the horse-radish usually takes full possession. Deep burying of the sets at the time the first crop is planted is also practised, the object, as in the first case, being to prevent the appearance of the former until the latter is almost mature.

Horse-radish makes its best growth in the cool autumn, steadily improves after September, and, not being injured by frost if undug, is usually left until late before harvesting with plow or spade. Storage in pits is best, since the roots lose less of their crispness, pungency and good appearance than if stored in cellars. In trimming for storage, the lateral roots are saved and buried for next season's planting. Exposure to air, sun and frost robs the roots of their good qualities and injures their vitality.

The insect enemies of this plant are those that attack other members of the cabbage family, the harlequin bug being the most dreaded. Remedies are the same as for other pests of this group of plants. Only two diseases have been reported, and these are seldom troublesome.

In the neighborhood of cities, especially where oysters are cheap, this crop is generally profitable, the usual retail price being 10 cents a pint, freshly grated, but without vinegar. This quantity weighs a scant half-pound. The cost of growing an acre is about as follows:

Cuttings, 10,000, at $2	$20 00
Fertilizer, 1,000 pounds	17 50
Cultivation, six times	6 00
Rent of land	5 00
Plowing, wear of tools, and so on	3 50
Setting roots, at 30 cents a 1,000	3 00
Total	$55 00

A marketable crop varies from 3,000 to 6,000 pounds, which may sometimes be sold as high as 5 cents a pound for first-class roots, and 2½ cents for second grade. Usually, however, prices seldom rise above 4 cents and 2 cents for the two grades. Under good cultivation, the proportion of No. 1 to No. 2 root is about 1 to 1 by weight. Lower prices may rule in well-supplied markets, and higher in poorly furnished, and when sold in small lots to retail graters, even 7 cents may be obtained. See *Radicula*.

M. G. KAINS.

HORTÊNSIA: *Hydrangea.*

HORTICULTURE (*hortus* a garden, originally an inclosure; *colere*, to care for or to cultivate). Horticulture is the growing of flowers, fruits and vegetables, and of plants for ornament and fancy. Incident to the growing of the plants are all the questions of plant-breeding, variation of plants under domestication, the bearings and applications of many biological and physical sciences, and the manufacture of many products. Primarily, horticulture is an art, but it is intimately connected with science at every point. From agriculture it has no definite boundary. It is, in fact, a department of agriculture, as forestry is; for agriculture, in its largest meaning, is the business of raising products from the land. It is customary, however, to limit the word agriculture to the growing of grains, forage, bread-stuffs, textiles, and the like, and to the raising of animals. In this restricted application it is practically coördinate, in a classificatory sense, with forestry and horticulture. The nursery business, as understood in North America, is considered to lie within the field of horticulture.

Etymologically, agriculture is the tending or cultivation of the fields (*ager*, field). Horticulture apparently was concerned with the area within the inclosure. Equivalent to horticulture in etymology is *gardening* (Anglo-Saxon *gyrdan*, to inclose, to which the verb *to gird* is allied). By custom, however, *garden* and *gardening* denote more restricted areas and operations than are implied in the term horticulture. The word *paradise* is connected with the idea of an inclosure and a garden or park. Early gardening books of the cyclopedia type are sometimes known as *paradisæ*. Parkinson's famous "Paradisus," or account of "a garden of all sorts of pleasant flowers," was published in England in 1629.

The only demarcation between horticulture and agriculture is the line of custom. Sweet potatoes are usually considered to be a horticultural crop in North

America, particularly in the northern states, but round or Irish potatoes are usually classed as an agricultural crop. Nor is there a definite division between horticulture and botany. The science of plants is botany; yet some of the most significant problems relating to plants—their response to the needs of man—have been resigned by the botanist to the horticulturist. Horticulture is a composite of botanical and agricultural subjects.

But horticulture is more than all this. It is a means of expressing the art-sense. Plant-forms and plant-colors are as expressive as the canvas work of the painter. In some respects they are more expressive, since they are things themselves, with individuality and life, not the suggestions of things. The painter's work excels in its power to suggest, and in its condensed portrayal of expression. But the essentials of a good landscape painting often can be presented in an artificially-made landscape. This effort to plant what the artist paints is modern. It is strictly not horticulture, although horticulture is contributory to the results, as paint-making is contributory to painting. Landscape-making is fundamentally a fine art. In this work it is treated under *Landscape Gardening*.

Horticulture divides itself into four somewhat coördinate branches, each branch comprising not only the raising of the crops but also such home or plantation manufacture as goes with the handling and the marketing of the materials (Annals Hort. 1891, 125–130):

Pomology, or fruit-growing;
Olericulture, or vegetable-gardening;
Floriculture, or the raising of ornamental plants for their individual uses or for their products;
Landscape horticulture, or the growing of plants for their use in the landscape (or in landscape gardening).

In the world at large, floriculture is the most important as measured by the number of persons interested, and by the number of species of plants that are grown (see *Floriculture*). In North America, pomology is the most important in commercial supremacy. North America is one of the great fruit-growing countries of the world (see *Fruit-Growing*). The growing of vegetables has been the last of these divisions to organize itself in the New World and to reach a commanding position (see *Vegetable-Gardening*). Landscape horticulture and landscape-gardening appeal to a constantly enlarging constituency with the growth of culture and of leisure and the deepening of the home life (see *Landscape Gardening*).

The occupation.

Strictly speaking, there are few horticulturists. The details are too many to allow any one person to cover the entire range. It is only those who look for principles who survey the whole field. Practitioners must confine themselves to rather close bounds. Consider that no less than 25,000 species of plants are in cultivation, each having its own requirements. Consider the great number of species which are actually on sale as registered in this Cyclopedia. The most important species vary immensely, the named and recorded forms often running into the thousands; and each of these forms has particular merits and often particular requirements. Consider that the requirements are likely to be different in any two places, and that the plants are profoundly modified by changes in conditions or in treatment. Consider the insect pests and fungous diseases and the many other kinds of hindrance that confront the cultivator. Consider, also, the vagaries of markets, which are ruled by questions of fancy more than by questions of necessity. There is probably no art in which the separate details are so many as in horticulture.

There is considerable diversity in the definition of the word "gardener." As understood by the gardening fraternity, it is described as follows by Patrick O'Mara: "In this country [North America] the man who grows vegetables for a livelihood is called a gardener, a market-gardener, and, in some sections, a trucker and a truck-farmer. We also have the florist, which embraces the man and woman who keep a flower-store, as well as those to whom the title properly belongs, viz., the persons who are cultivators of flowers. We have also the nurseryman, a calling separate and distinct from these, and yet the three must be combined in one individual to make a qualified gardener, or what is generally known as the 'private' gardener. Occasionally the so-called 'private' gardener is known as a 'manager' or 'superintendent,' but it may well be questioned if he gains honor thereby. When he leaves the place where the title was assumed or thrust upon him, it very frequently is left behind, but he still remains a gardener. It also tends to create an artificial distinction between many who are equals, and many in and out of the ranks believe it should be discouraged. Gardeners who have charge of public parks, cemeteries and botanic gardens, it has always been admitted, may with perfect propriety assume the name of superintendent, but the fact remains that no man who loves his craft need be ashamed to be known professionally by the 'grand old name of gardener.' . . .

"However, as there may be some danger of a man's true position in gardening not being defined in that word, I would suggest that the word professional be used to qualify it. In the eyes of some outside the ranks, it might have weight, and it would certainly be a proper distinction from the amateur gardener, the trucker, the nurseryman and the commercial florist. It would be well also to have all gardeners' societies known as an association of professional gardeners. It might operate to classify properly those who are entitled by education, experience and natural ability to bear the title from those who, lacking all these, are yet bold enough to call themselves gardeners and to become candidates for positions which they are unable to fill with credit to themselves, with justice to their prospective employers or with a proper regard for the responsibilities they are so willing to assume. That class would be bolder than I imagine them to be if they would, under such circumstances, assume the title of professional gardener, and the well-merited ridicule which would inevitably follow the discovery of their false pretenses would be a salutary check upon others. To have a claim upon the title, a man should be able to grow flowers, fruits and vegetables both outdoors and under glass, care for trees and shrubs, lawns and roads, in short attend to every detail connected with his calling. If in addition he knows how to attend to the details of gentlemen's farming, his services should be all the more valuable. He could then assume entire charge of a place where both farming and gardening are done, and we would, if more men were capable of this, be spared the pain of seeing one or both suffer either from incompetence or want of coöperatoin between the gardener and farmer."

Proceeding to a discussion of the gardener's work, O'Mara continues, in his address "The Professional Gardener's Mission in Horticulture" before the Lenox (Massachusetts) Horticultural Society in 1897, as follows: "It is to that class, then, that we must look for developments of an upward tendency and they will be held responsible for any retrogression in ornamental horticulture, for they are before all others the recognized exponents of the art. It is their mission to improve, and the general opinion is that there is room for improvement, more especially in indoor horticulture. The overwhelming tendency during the past ten to fifteen years has been to make the so-called 'private place' nothing more nor less than a cut-flower establishment and a hospital for the decorative plants which are used in the dwelling-house and for outside

decoration in summer; so pronounced has this become that the only difference between the commercial establishment of today and the average private greenhouse is one of size and architecture. The latter instead of being maintained, as it should be, purely to gratify esthetic tastes, is devoted to an utilitarian purpose mainly. The product is counted and reckoned at so many dollars and cents. The most the average owner sees of them is the daily or semi-weekly cut which is sent to the house. This is not as it should be, and while it is not the gardener's fault, and may not be within his power to control, yet by well-timed suggestion and persistence, he should be able to effect a gradual and much-to-be-desired change.

1850. Early picture of an American plant. Monardes (1571).

"The greenhouses should be a place of recreation for the owners, who should be induced to visit them daily, to look forward with pleasure to that visit, and the best way to accomplish this is to induce them to get a good collection of plants. A house of roses, carnations, violets or chrysanthemums has not the attraction of a varied collection, a collection, too, that embraces in their season gloxinias, tuberous begonias, cinerarias, cyclamens, caladiums, ixias, sparaxis, primulas, and other seasonable pot-plants, both flowering and ornamental foliage. It is freely admitted that variety is the soul of gardening and not less so in small than in large places. The individual preferences of the proprietor or gardener should therefore in some measure be rendered subservient to the amount of pleasure which visitors are sure to obtain from a variety of plants. I am well aware that in many places the proprietor's residence is of short duration and very often during the summer months only, so that it is difficult, nay, well nigh impossible, for the gardener to influence him in the right direction; but if all earnestly try, some are sure to succeed, and the example once set, it will soon become general."

Of horticulture there are two general types,—that associated immediately with the home life, and that undertaken primarily for the gaining of a livelihood. The former is amateur horticulture. Those things are grown that appeal to the personal tastes: they are grown for oneself. The latter is commercial horticulture. Those things are grown that the market demands: they are grown for others. In all countries, commercial horticulture is a relatively late development. General agriculture is usually the primary means of earning a living from the soil. For the most part, horticulture comes only with the demand for the luxuries and refinements of life; it does not deal with what we call the staple food-stuffs.

It is not the purpose of this sketch to trace the general history of horticulture. If one desires such outlines, he should consult the Bohn edition of Pliny's "Natural History;" Loudon's "Encyclopædia of Gardening;" G. W. Johnson's "History of English Gardening;" Amherst's "History of Gardening in England;" Sieveking's "Gardens, Ancient and Modern;" Jäger's "Gartenkunst und Gärten, sonst und jetzt;" Hüttig's "Geschichte des Gartenbaues;" the historical chapters of André's "L'Art des Jardins." Mangin's "Histoire des Jardins Anciens et Modernes." For the histories of cultivated plants, see DeCandolle's "Origin of Cultivated Plants;" Hehn & Stallybrass' "Wanderings of Plants and Animals from their first Home;" Pickering's "Chronological History of Plants."

Early American history.

In North America there was little commercial horticulture before the opening of the nineteenth century. There were excellent home gardens more than a century ago, in which many exotic plants were growing; yet, in proportion to the whole population, these gardens were isolated. The status of any modern time is accurately reflected in its writings. It may be well, therefore, to bring in review the leading early horticultural writings of this country. Few studies have been made of our horticultural history. The best is the introductory sketch, by Robert Manning, in the "History of the Massachusetts Horticultural Society," 1880. For its field, Slade's "Evolution of Horticulture in New England," 1895, is interesting. In a still narrower field, Boardman's "Agricultural Bibliography of Maine" is critical and invaluable. The chapter on "American Horticulture," by Alfred Henderson, in Depew's "One Hundred Years of American Commerce," 1895, presents the commercial side of the subject. Another fragment of the history is presented in the writer's "Sketch of the Evolution of our Native Fruits," 1898. Histories from several points of view are presented in the "Florists' Exchange" for March 30, 1895; and the writer has incorporated parts of his own contribution to that history in the sketch that follows. One may find valuable historical material in the reports of societies devoted to horticulture and agriculture; and the files of the early journals must not be overlooked. Local histories are important. All these sources have not yet been carefully explored.

The history of the subject needs to be written from the economic side, as one part in the industrial history of North America, but this has not yet been attempted. The best that may be done here is to trace some of the events from the side of the literature.

The earliest writings on American plants were by physicians and naturalists who desired to exploit the wonders of the newly discovered hemisphere. The earliest separate writing is probably that of Nicolo Monardes on the products of the New World, which was published in Seville in parts, from 1565 to 1571. The completed treatise was translated into Italian, Latin,

English and French. An English edition of 1577 was entitled, "Joyfull Newes out of the newe founde worlde, wherein is declared the rare and singular vertues of diverse and sundrie Hearbes, Trees, Oyles, Plantes, and Stones. . . . Also the portrature of the saied hearbes. . . . Englished by J. Frampton." Monardes is now remembered to us in the genus Monarda, one of the mint tribes. He wrote of the medicinal and poisonous plants of the West Indies, and gave pictures, some of them fantastical. His picture of tobacco is not greatly inaccurate, however; and it has the distinction of being probably the first picture extant of the plant, if not of any American plant. This picture is here reproduced (Fig. 1850) exact size, to show the style of illustration of three and one-third centuries ago. Jacques Cornutus is generally supposed to have been the first writer on American plants. His work, "Canadensium Plantarum . . . Historia," appeared in 1635, and it also had pictures.

One of the earliest writers on the general products and conditions of the northern country was John Josselyn, who, in 1672, published a book entitled "New England's Rarities discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country," and in 1674 a second volume, "An Account of Two Voyages to New England, made during the years 1638, 1663." The "Rarities" gives specific accounts of many plants, together with pictures of a few of them, as for example, the pitcher plant. He mentions the plants which had become naturalized from Europe. There is also a list "Of such Garden Herbs (amongst us) as do thrive there, and of such as do not." This list, perhaps the earliest record of the kind, is here transcribed:

Cabbidge growes there exceeding well.
Lettice.
Sorrel.
Parsley.
Marygold.
French Mallowes.
Chervel.
Burnet.
Winter Savory.
Summer Savory.
Time.
Sage.
Carrats.
Parsnips of a prodigious size.
Red Beetes.
Radishes.
Turnips.
Purslain.
Wheat.
Rye.
Barley, which commonly degenerates into Oats.
Oats.
Pease of all sorts, and the best in the World; I never heard of, nor did see in eight Years time, one Worm eaten Pea.
Garden Beans.
Naked Oats, there called Silpee, an excellent grain used insteed of Oat Meal, they dry it in an Oven, or in a Pan upon the fire, then beat it small in a Morter.
Spear Mint.
Rew, will hardly grow.
Fetherfew prospereth exceedingly.
Southern Wood, is no Plant for this Country. Nor
Rosemary. Nor
Bayes.
White Satten groweth pretty well, so doth
Lavender Cotton. But
Lavender is not for the climate.
Penny Royal.
Smalledge.
Ground Ivy, or Ale Hoof.
Gilly Flowers will continue two Years.
Fennel must be taken up, and kept in a warm Cellar all Winter.
Houseleek prospereth notably.
Holly hocks.
Enula Campana, in two Years time the Roots rot.
Comferie, with white Flowers.
Coriander, and
Dill, and
Annis thrive exceedingly, but Annis Seed, as also the Seed of Fennel, seldom comes to maturity; the Seed of Annis is commonly eaten with a fly.
Clary never lasts but one Summer, the Roots rot with the Frost.
Sparagus thrives exceedingly, so does
Garden Sorrel, and
Sweet Bryer, or Eglantine.
Bloodwort but sorrily, but
Patience, and
English Roses, very pleasantly.
Celandine, by the West Country men called Kenning Wort, grows but slowly.
Muschata, as well as in England.
Dittander, or Pepper Wort, flourisheth notably, and so doth Tansie.
Musk Mellons are better than our English, and
Cucumbers.
Pompions, there be of several kinds, some proper to the Country, they are dryer then our English Pompions, and better tasted; you may eat them green.

Tuckerman, who edited an edition of Josselyn in 1865, comments as follows on the foregoing lists: "The earliest, almost the only account that we have of the gardens of our fathers, after they had settled themselves in their *New* England, and had tamed its rugged coasts to obedience to English husbandry. What with their garden beans, and Indian beans, and pease ('as good as ever I eat in England,' says Higginson in 1629); their beets, parsnips, turnips, and carrots ('our turnips, parsnips, and carrots are both bigger and sweeter than is ordinary to be found in England,' says the same reverend writer); their cabbages and asparagus,—both thriving, we are told, exceedingly; their radishes and lettuce; their sorrel, parsley, chervil, and marigold, for pot-herbs; and their sage, thyme, savory of both kinds, clary, anise, fennel, coriander, spearmint, and pennyroyal, for sweet herbs,—not to mention the Indian pompions and melons and squanter-squashes, 'and other odde fruits of the country,'—the first-named of which had got to be so well approved among the settlers when Josselyn wrote in 1672, that, what he calls 'the ancient New England standing dish' (we may call it so now!) was made of them; and, finally, their pleasant, familiar flowers, lavender-cotton and hollyhocks and satin ('we call this herbe, in Norfolke, sattin,' says Gerard; 'and, among our women, it is called honestie') and gilly-flowers, which meant pinks as well, and dear English roses, and eglantine,—yes, possibly, hedges of eglantine, —surely the gardens of New England fifty years after the settlement of the country, were as well stocked as they were a hundred and fifty years after. Nor were the first planters long behindhand in fruit. Even at his first visit, in 1639, our author was treated with 'half a score of very fair pippins,' from the Governor's Island in Boston Harbor; though there was then, he says, 'not one apple tree nor pear planted yet in no part of the country but upon that island.' But he has a much better account to give in 1671: 'The quinces, cherries, damsons, set the dames a work. Marmalad and preserved damsons is to be met with in every house. Our fruit trees prosper abundantly,—apple trees, pear trees, quince trees, cherry trees, plum trees, barberry trees. I have observed, with admiration, that the kernels sown, or the succors planted, produce as fair and good fruit, without grafting, as the tree from whence they were taken. The countrey is replenished with fair and large orchards. It was affirmed by one Mr. Woolcut (a magistrate in Connecticut Colony), at the Captain's messe (of which I was), aboard the ship I came home in, that he made five hundred hogsheads of syder out of his own orchard in one year.'—*Voyages*, pp. 189, 190. Our barberry-bushes, now so familiar inhabitants of the hedge-rows of eastern New England, should seem from this to have come, with the eglantines, from the gardens of the first settlers. Barberries 'are planted in most of our English gardens,' says Gerard."

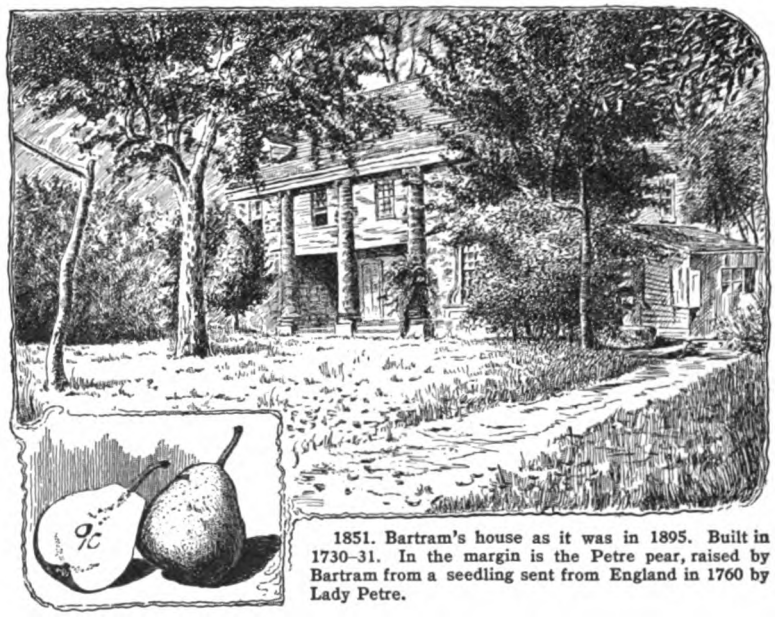
The foregoing lists and comments show that the colonists early brought their familiar home plants to the new country; and there are many collateral evidences of the same character. There was long and arduous experimenting with plants and methods. Several things which were tried on a large scale failed so completely, either from uncongenial conditions or for economic reasons, that they are now unknown to us as commercial crops; amongst these are indigo, silk and the wine grape. The histories of these things can be traced

only as a refrain in contemporary writing. Indian corn, tobacco and cotton early became the great staple crops.

The Indians cultivated corn, beans, pumpkins and other plants when America was discovered. They soon adopted some of the fruits which were introduced by the colonists. William Penn and others found peaches among the Indians. Orchards of peaches and apples were found in western New York by Sullivan's raid against the Six Nations in revolutionary times. Josselyn, Roger Williams, Wood and others speak of the corn and squashes of the Indians. The word squash is adopted from the Indian name, *squontersquash*, *askutasquash*, or *isqoutersquash*. C. C. Jones, in his "History of Georgia," in describing the explorations of De Soto, says that before reaching the Indian town of Canasagua (whose location was in Gordon County, Georgia), DeSoto "was met by twenty men from the village, each bearing a basket of mulberries. This fruit was here abundant and well flavored. Plum and walnut trees were growing luxuriantly throughout the country, attaining a size and beauty, without planting or pruning, which could not be surpassed in the irrigated and well-cultivated gardens of Spain." For critical notes on the plants cultivated by the American aborigines, see Gray and Trumbull, "American Journal of Science," Vol. XXV (April, May), Vol. XXVI (August). For an account of plant products used by the Indians, see G. K. Holmes, "Cyclopedia of American Agriculture," Vol. IV, p. 24.

"Fruit-growing among the Indians of Georgia and Alabama in the early history of these states," writes Berckmans, "is demonstrated by the large quantity of peaches which the Indian traders of the early colonial period found growing in the Creek, Cherokee and Choctaw villages. It is on record that Indians often made long trips to other tribes for exchanging various articles of their making, and thus the seed from those peach trees was undoubtedly procured from the Florida Indians, who, in turn, procured these from the trees planted by the Spanish explorers. The peculiar type of 'Indian peaches,' found throughout the South and recognized by the downy and striped fruit and purple bark on the young growth, was introduced from Spain and gradually disseminated by the Indians. Apple-growing was quite extensively carried on by the Cherokee Indians in the mountain regions of Georgia, Alabama and North Carolina. The trees being all seedlings, as grafting was likely unknown to the Red Man, vestiges of old apple trees originally planted by these denizens of the South are still occasionally found in upper Georgia. Sixty years ago a large collection of apples was introduced into cultivation, and today many of the best southern winter apples owe their origin to the Indians, who procured the first seeds from traders."

One of the earliest glimpses of plant-growing in the New World is an account in the "Philosophical Transactions of the Royal Society," early in the eighteenth century, by Chief Justice Paul Dudley, of Roxbury, near Boston. In the "Abridgement of the Transactions" are the following notes, amongst others, under the date 1724: "The plants of England, as well as those of the fields and orchards as of the garden, that have been brought over into New England, suit very well with the soil, and grow to perfection. The apples are as good as those of England, and look fairer, as well as the pears; but they have not all of the sorts. The peaches rather excel those of England, and there is no trouble or expence of walls for them; for the peach trees are all standards, and Mr. Dudley has had, in his own garden, 700 or 800 fine peaches of the rare-ripes, growing at a time on one tree. . . . The peach trees are large and fruitful, and commonly bear in three years from the stone. . . . The common cherries are not so good as the Kentish cherries of England; and they have no dukes, or heart-cherries, unless in two or three gardens." It was reported that people of "late years have run much upon orchards." The product of these orchards was chiefly cider. "Some of their apple trees will make six, some have made seven barrels of cider; but this is not common; and the apples will yield from seven to nine bushels for a barrel of cider: a good apple tree will measure from 6 to 10 feet in girt." Dudley mentions a bloomless apple, and "the tree was no graft." In common with other new countries, New England astonished persons with the luxuriant growth of the plants. "An onion, set out for seed, will rise to 4 feet 9 inches in height. A parsnip will reach to 8 feet; red orrice [orach will mount 9 feet; white orrice 8. In the pastures he measured seed mullen 9 feet 2 inches in height, and one of the common thistles above 8 feet." Record is made of a pumpkin vine which grew unattended in a pasture. It made a single stem which "ran along over several fences, and spread over a large piece of ground far and wide." "From this single vine were gathered 260 pumpkins; one with another as large as a half peck; enough in the whole, to fill a large tumbrel, besides a considerable number of small and unripe pumpkins." Indian corn was "the most prolific grain." The observations and experiences of John Lawson in North Carolina should not be overlooked. He was in the country 1700 to 1708, and wrote a history of the state, describing its natural productions. He found considerable success there in grape-growing.



1851. Bartram's house as it was in 1895. Built in 1730–31. In the margin is the Petre pear, raised by Bartram from a seedling sent from England in 1760 by Lady Petre.

The colonial ornamental gardens were probably unlike our own in the relative poverty of plants, absence of landscape arrangement, rarity of greenhouses, and lack of smooth-shaven lawns (for the lawn-mower was not invented till last century). These gardens

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were of two general types: the unconventional personal garden, without form but not void, in which things grew in delightful democracy; the conventional, box-bordered, geometrical garden, in which things grew in most respectful aristocracy. There were many interesting and elaborate private gardens in the colonial days. One of the earliest and best was that of Governor Peter Stuyvesant, of New Amsterdam (New York, near Third Avenue), known as the "Bouwerie," where forty or fifty negro slaves, and also white servants, were kept at work. "The road to the city has been put in good condition, and shade trees were planted on each side where it crossed the Governor's property." The Bowery of these degenerate days has lost the Eden-like features that distinguished its illustrious progenitor.

Excellent gardens were attached to the residences of wealthy persons by the middle of the eighteenth century, and probably earlier, and they were said to have been encouraged by the example and precept of Washington. There are records of many meritorious collections of plants a century and more ago. William Hamilton's collection at Philadelphia was one of the best, and it contained a large collection of exotics. It flourished toward the close of the eighteenth century, and was broken up in 1828. William Jackson began "a highly interesting collection of plants at his residence in Londongrove," Pennsylvania, in 1777. About 1800 Joshua and Samuel Pierce, East Marlborough, Pennsylvania," began to adorn their premises by tasteful culture and planting," and by the establishment of an arboretum of evergreens. The most famous botanic garden which North America has had was John Bartram's, established at Philadelphia in 1728 (p. 530). It contained a great collection of native plants, and some of the trees are now amongst the most valued landmarks of the city. Bartram was a skilful farmer and gardener, and his sons, John and William, inherited his tastes and continued the garden. The elder Bartram was probably the first American to perform successful experiments in hybridization. Bartram's house (Fig. 1851), built by himself, is still one of the sights of the environs of Philadelphia, and the site of the garden, with many of the old trees standing, is now happily a public park. Bartram's cousin, Humphry Marshall, established a botanic garden at West Bradford, in Chester County, Pennsylvania, in 1773 (p. 348). John Bartram's name is preserved in the moss Bartramia, and Marshall's in the genus Marshallia, applied to small Compositæ of the eastern states. The Elgin botanic garden, near New York, was established in 1801 by David Hosack, a man of great learning and of the keenest sympathies with rural occupations. He is now remembered in the interesting genus Hosackia, one of the Leguminosæ. A botanic garden was established at Charleston, South Carolina, about 1804, and one in Maryland about the same time. The Botanic Garden at Cambridge, Mass., was begun in 1805, an institution which, together with the Professorship of Natural History at Cambridge, was founded largely through the efforts of the Massachusetts Society for Promoting Agriculture. The society subscribed $500 for the purpose, and raised more by subscription.

Development of horticulture in Canada in particular. (W. T. Macoun.)

Horticulture in Canada is about 300 years old. Its development began with the French who settled in Acadia (now the province of Nova Scotia), and along the banks of the St. Lawrence River, and planted seeds and trees brought with them from France. Owing to the small population and the difficulty in transportation, it was not until about sixty years ago that commercial horticulture may be said to have begun (say about 1850), but with the rapid increase of population and transportation facilities the development in recent years has been rapid. The growth of the fruit industry in the province of Ontario may be given as an example of how rapidly horticulture is developing in Canada. In 1859 the Ontario Fruit-Growers' Association was formed. In 1881 the first coöperative shipments of fruit were made, but coöperation was slow in developing for some years after. Spraying with paris green for the control of codlin-moth was practised in 1889 and shortly afterward spraying with bordeaux mixture for the control of apple-scab was begun. In 1895 the Department of Agriculture began to give demonstrations in spraying. Now spraying is very general throughout Canada. In 1894, fruit experiment stations, mainly for testing varieties of fruits, were established in different parts of Ontario by the provincial government. By 1904, the coöperative movement was developing rapidly, by 1908 there were thirty-five coöperative organizations in the province, and in 1914 there were fifty-seven. In 1904, the first provincial fruit and flower show was held in the city of Toronto and there has been one annually ever since, its importance increasing every year. The agricultural college at Guelph, through its horticultural courses, has been of great assistance in the development of this industry. The district representatives who carry demonstration work and diffuse information throughout the counties have been of great service in the different provinces. In other provinces, especially in the provinces of Nova Scotia and British Columbia, there has also been great development in fruit-culture in recent years.

The Dominion government has done much to aid horticulture in Canada. The Experimental Farms were established in 1887, on an Act passed in 1886, and now there are eighteen scattered from the Atlantic to the Pacific (page 1195). The Fruit Marks' Act (now the Inspection and Sales Act), passed in 1901, has materially helped the fruit industry in establishing definite grades of apples and requiring more careful packing than in former years. Other Acts passed by the Dominion government in recent years have been a great aid. In recent years, fruit crop-reports have been published monthly, part of the year, which have been of great assistance to the fruit-growers.

The canning of fruit is developing rapidly in Canada and the outlook for still more extensive growth in this branch of the industry is very bright.

The census of Canada for 1911 gives the total number of fruit trees in Canada as 20,812,556; the area occupied by fruit trees as 376,322 acres and the estimated capital value of fruit trees as $127,000,000.

As Canadians have become better off, there has been a growing demand for flowers and vegetables out of season and there has been a fairly rapid increase in the area under glass. It is estimated that there are now over 6,000,000 square feet devoted to floriculture, with an estimated capital invested of $1,500,000, and an annual output of $1,800,000; but this will soon be much larger.

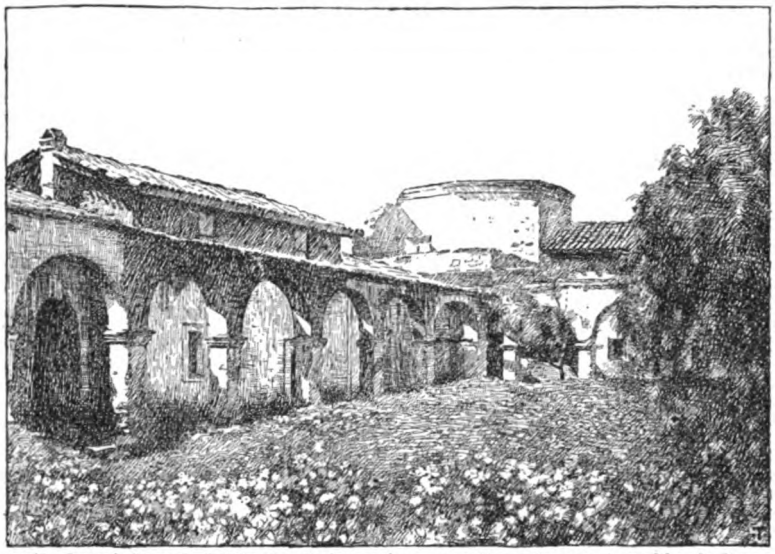
The growing of vegetables began with the first settlement of Canada, and as the villages, towns and cities multiplied, the vegetable-growers supplied their needs. Now there are large areas devoted to the commercial culture of vegetables. In the province of Ontario many vegetables are canned and large quantities of corn and tomatoes particularly are grown for this purpose. In recent years the vegetable-growers have organized and in Ontario there is a provincial association.

For further information, see *British North America*, Vol. I, pp. 559–76.

Early horticulture in California in particular. (Charles Howard Shinn.)

California horticulture is in the main patterned after the south-European types, and to this extent it originated from Spanish-Mexican sources. The horticulture of California's high mountain valleys approxi-

mates more closely to that of colder regions, while the horticulture of the Pacific slope, north of California, becomes more and more different from the south-European types, but still has many characteristics of its own separating it sharply from that of the Atlantic slope. The first horticultural experiments in California were at the Missions of the Peninsula (Bajo or Lower California), where twenty-two Missions were founded between 1697 and 1797 (Fig. 1852). Here the Mission Fathers introduced the date palm; also oranges, lemons, limes, pineapples, bananas, olives, figs, pomegranates, peaches, quinces, plums, apples, pears and grapes. They shipped to Monterey and the northern missions large quantities of dried figs, grapes, dates, and peaches. The Upper California missions received seeds, cions, and so on, from those of Lower California, as well as from Mexico. The first of these missions was established in 1769 at San Diego by the Franciscans,



1852. One of the early California missions, where were the early promoters of horticulture on the western coast.—San Juan Capistrano.

under the leadership of Father Junipero Serra, whose name visitors to the California State Building at the World's Fair will recall in connection with the great date palm from the Mission Valley of San Diego. This palm was raised from seed which Junipero Serra planted about 1770. Twenty-one missions were founded by the Franciscans, the last one in 1823, and at all but one or two of them there were important collections of the fruits of southern Europe—olives, figs, oranges, lemons, pomegranates, wine grapes, and also apples, pears and peaches. Early in this century the Mission of San Gabriel had over 2,000 fruit trees, and others had more than a thousand. Fig. 1852 shows the yard of San Juan Capistrano Mission, as it existed in 1889. There are also some traces in California of the fruits of the few early Russian settlements. With the American occupation and the immigration from the east, came the eastern American types of fruits, and the state is now the seat of a wonderfully varied fruit-culture, although the small-fruits have not yet attained that prominence which they enjoy in older countries.

The first official horticultural reports from California appeared in the second part of the United States Patent Office Report for 1851. In this report, A. Williams, of San Francisco, presented statistics from the Horner Ranch, near the Mission San Jose, Alameda County, where 800 acres were planted in vegetables and the crop of 1851 sold for upwards of $200,000. The crop of potatoes, onions, beets, turnips and tomatoes was 134,200 bushels. The same report noted an onion weighing twenty-one pounds, and at the Fair of 1853 the committee on vegetables reported a "white flat turnip" weighing thirty-three pounds, a squash that weighed one hundred and twenty-one pounds, and a tomato weighing five and one-half pounds. Thus early California began to boast of the mammoth productions of her soil. The first official report printed in California appeared in a document issued by the secretary of state for 1852. The capital then employed in "fruits and orchards" was given at $366,910. The market-garden interests were surprisingly large; among single items were "460,000 pumpkins, worth $46,000;" upward of 5,000,000 pounds of onions, "worth $186,000;" 30,000 bushels of beans, "worth $72,000." Santa Barbara County reported "1,370 barrels of olives, worth $27,-500." Horticultural statistics are continued in the reports of the state surveyor general. In December, 1853, the State Agricultural Society of California was organized, after a successful exhibition in San Francisco, where almonds, figs, olives, walnuts, and many other fruits, as well as vegetables and flowers, were shown.

Fairs were held in 1854 and 1855, but were not officially reported. The state began to publish the proceedings of the agricultural society in 1858, when its membership was 856, and annual reports have continued till the present time. The California Horticultural Society was organized April 5, 1881; in 1883, the State Board of Horticulture was established. Reports of these bodies and of the state fruit-growers' conventions have appeared annually or biennially since 1882. The State Viticultural Commission was organized in 1881, and its reports continued until 1894. Upward of one hundred octavo volumes represent the official output of California since 1858 in lines of horticulture, including, of course, the California Experiment Station reports.

Among the special California horticultural literature that appeared prior to 1900, are the following: "California Fruits," E. J. Wickson, first edition, 1889; second edition, 1891; third edition, 1900. So many changes and additions have occurred in this book that all three editions will be found very useful in libraries. "California Vegetables," E. J. Wickson, 1897. "Gardening in California," Wm. S. Lyon, Los Angeles, 1897. This is a small volume of 156 pages. "Olive Growing," Pohndorff, San Francisco, 1884. "Olive Culture," A. Flamant, San Francisco, 1887. "The Olive," Arthur T. Marvin, San Francisco, 1888. "The Raisin Industry," Gustav Eisen, San Francisco, 1890. "The Wine Press and Cellar," E. H. Rixford, San Francisco, 1883. "Grape Culture, a Handbook for California," T. Hart Hyatt, San Francisco, 1876. "Orange Culture in California," Thomas A. Garey, San Francisco, 1882. Contains appendix on grape-culture, by L. J. Rose. "Orange Culture," W. A. Spalding, Los Angeles. "The California Farmer," established in January, 1854, and maintaining a spasmodic existence for a number of years, printed the first pomological and horticultural reports of committees, and the like. "The Pacific Rural Press" was established in 1871, in San Francisco, and still continues. "The Rural Californian," of Los Angeles, still in existence, was estab-

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lished in 1877. "The California Fruit-Grower," began in 1888, and survives as the "California Fruit News." "The California Cultivator," of Los Angeles, established in 1884, is still published. "The Pacific Tree and Vine," of San José, established in 1884, is no longer published.

Sometimes we are inclined to think that the literature of the garden began on the Pacific coast in the age of steam presses, telegraphs and transcontinental railroads. It is not so; and we should go farther back than the excellent writings listed above. The "first fine rapture" of discovery and conquest gave birth to a splendid enthusiasm for the flowers and plants of the vast unfenced wilderness stretching from Texas to Oregon, and one finds its expression in hundreds of books of travel, in ponderous government reports, in forgotten periodicals and, to some extent in the whole outdoor literature of Europe and America during the exciting period of the gold rush to California.

We once had many and very quaint publications in California, all dead and forgotten now, but still worth studying in the libraries. There was the old "Alta California," the "California Farmer," the "Golden Era," the "Hesperian," the "Pioneer," "Hutching's Pioneer Magazine." They contained stilted essays, sketches and stories, often modeled after forgotten literary patterns of New York and Paris. But their descriptive writings first broke away from these hampering traditions, and shaped themselves anew under California skies. Ewer, "Shirley," Hutchings, Wadsworth, Dr. Kellogg and a few others wrote of things as they saw them, and in some degree caught the outdoor charm of the new land as it was slowly yielding to spade and plow.

But there had been a still earlier discovery of the floral wealth of the Pacific coast. Long before Marshall's mill-race gleamed with that fateful flake of gold, the botanists and collectors had sent forth a cry of delight that stirred the pulses of Europe. The letters, journals and various contributions to descriptive and scientific literature, made by the long line of botanical explorers who visited this coast between 1790 and 1848, should be a part of this record. Among these enthusiasts were men like Langsdorf, who accompanied that unfortunate Count Rozanoff of Bret Harte's beautiful poem, and Chamiso and Eschscholtz. The last two, friends close-linked in literature and science, gave our orange-hued poppy its consonantal name.

The starting-point, however, for most students of the floral resources of California is with the extensive work done by David Douglas (1825–1833), under the auspices of the Royal Horticultural Society of England. In the proceedings of that Society one finds some of his reports and the first colored plates ever issued of many California bulbs. The second volume of Hooker's "Companion to the Botanical Magazine" contains his fascinating letters. After Douglas came Coulter, Nuttall, Hartweg and others, and then the famous groups of botanical explorers whose work appears in government publications, such as the Pacific Railroad and Boundary Survey reports. Men like Gray, Thurber, Newberry, Torrey, Engelmann and Parry wrote much that was a real gift to the literature of the period, and in many cases they had for illustrations those wonderful pen-and-ink drawings made by T. C. Hilgard.

But, if one says that government reports are only the "raw material" of outdoor literature, then turn to Edinburgh, in 1859–1860, when Dr. Andrew Murray published his two parts of "Notes on California Trees," compiled chiefly from the letters of his brother Wm. Murray of San Francisco, and illustrated with superb lithographs of the sequoias. It was in 1860, also, that Thomas Starr King wrote a very charming account of a trip "Around the Bay in the season of flowers," when, as he expressed it, there were "flowers by the acre, flowers by the square mile."

Here we begin to reach the modern way of looking at things. All through the pages of the publications of the State Agricultural Society between 1856 and 1860, the early reports of the State Surveyor General, the "State Register" for 1857–60, the rambling surveys of Dr. Trask, the first state geologist, we have had somewhat obscure glimpses of a land overflowing with growth and blossom. We have seen the pioneer surveyors, Day and Goddard and the rest, camping in the lily-beds of the high Sierra valleys; we have watched pioneer committees going around, away back in the early fifties, to tell us, all too briefly, of the glories of Shell Mound Nurseries, the New England Gardens, Hook Farm, Fontainbleau, and other places now, alas! in ruins. We hear of Fox, Sontag, Prevost, Macondray, Lewelling. These reports, though hardly the literature of the garden, are very excellent materials out of which, some of these days, the right man or woman will reconstruct the whole story, and give us our long-needed book on "California Floriculture."

The "modern note" in our garden literature, aside from the glowing essays of Thomas King, was also manifest in some of the California writings of Dr. Bushnell. Then it found fuller expression in the pages of the "Overland Monthly," where Muir, the LeContes, Avery, Williams, Miss Coolbirth, Bartlett and Sill, and a little later, some of Professor Sill's pupils, made for a few years a very striking presentation of the life, color, strength and beauty of outdoor California. Much of the best writing of this period between 1868 and 1875 appeared in the "Bulletin," "Argonaut," "California Horticulturist" and "Rural Press." It is notable historically, because it covers the whole field. Nothing that is now being written about gardens and flowers is in its way any better than some of the work, signed and unsigned, that appeared in the "Overland Monthly," and in other San Francisco publications in the days before the gaudy splendors of the sensational Sunday newspapers.

In the way of distinctive floral publications we have had two of importance: The first, the "California Horticulturist," founded by F. A. Miller in 1870, lasted ten years. One of its most interesting editors was the late E. J. Hooper, one of the owners of the "Western Farmer and Gardener," established by him in Cincinnati in 1839 and 1840. Plates of fruit and flowers, colored by his hands, appear in early volumes of the "California Horticulturist." The still earlier and yet more rare "California Culturist" of W. Wadsworth, which began with June, 1858, and continued two years, contained a good deal of floriculture.

In May, 1888, at Santa Barbara, appeared the "California Florist," an attractive publication which soon moved to San Francisco and there continued until May, 1889. Since that date, outside of trade publications, catalogues, and occasional pamphlets, the floral interests of California have been, most of the time, without a separate publication, but they have never lacked for space, whenever required, in other periodicals.

There have been few books in the past twenty-five years which deal other than casually with the floral field, but there have been many and excellent botanies, chiefly local, and more are being written, so that before long the whole field will be covered, and brought down to date with revised nomenclature and description. In these brief limits, one cannot expect even a partial bibliography, of either the popular or the technical writings of California botany or floriculture. Beginning with the writings of Kellogg, Bolander, Lemmon, Miller, Ludeman, Sievers, Wickson, Rixford, and others, the list ends with the many bright people who write for the press on these topics at the present time. The standard early work on California plants is Brewer and Watson's "Botany of California," comprising two volumes of the State Geological Survey, published 1876–1880. Books like Bartlett's "Breeze from the Woods,"

and Mary Elizabeth Parson's "Wild Flowers of California," and such pamphlets as Lyon's "Gardening in California" and Krause's "Sweet Pea Review" have a real historial value. Prominent among our notable books are Kellogg's "Forest Trees," his "West American Oaks," and Green's "Flora Franciscana." Later is Jepson's "Flora of Western Middle California," 1901, with a second edition in 1911. He is now preparing a "Flora of California," several parts of which have been issued.

Native species of fruits and vegetables.

Before passing to a discussion of the departments or subdivisions of the subject, we may pause to consider the general contribution that the North American continent has made to the species of food-plants of a horticultural character. The remarks are taken from Hedrick (presidential address, Society of Horticultural Science, 1913), who has presented an excellent running summary: "The continent is a natural orchard. More than 200 species of tree, bush, vine and small fruits were commonly used by the aborigines for food, not counting nuts, those occasionally used, and numerous rarities. In its plums, grapes, raspberries, blackberries, dewberries, cranberries and gooseberries North America has already given the world a great variety of new fruits. There are now under cultivation 11 American species of plums, of which there are 433 pure-bred and 155 hybrid varieties; 15 species of American grapes with 404 pure and 790 hybrid varieties; 4 species of raspberries with 280 varieties; 6 species of blackberries with 86 varieties; 5 species of dewberries with 23 varieties; 2 species of cranberries with 60 varieties and 2 gooseberries with 35 varieties. Here are 45 species of American fruits with 2,226 varieties, domesticated within approximately a half-century.

"Few plants grow under such varied conditions as our wild grapes. Not all have been brought under subjugation, though nearly all have horticultural possibilities. It is certain that some grape can be grown in every agricultural region of the United States. The blueberry and huckleberry, finest of fruits, and now the most valuable American wild fruits, the crops bringing several millions of dollars annually, are not yet domesticated. Coville has demonstrated that the blueberry can be cultivated. [See *Blueberry*, Vol. I, p. 515.] Some time we should have numerous varieties of the several blueberries and huckleberries to enrich pine plains, mountain tracts, swamps and waste lands that otherwise are all but worthless. A score or more native species of gooseberries and currants can be domesticated and should some time extend the culture of these fruits from the Gulf of Mexico to the Arctic Circle. There are many forms of juneberries widely distributed in the United States and Canada, from which several varieties are now cultivated. The elderberry is represented by a dozen or more cultivated varieties, one of which, brought to my attention the past season, produced a half hundred enormous clusters, a single cluster being made up of 2,208 berries, each ⅓ inch in diameter.

"These are but a few of the fruits—others which can only be named are: the anonas and their kin from Florida; the native crab-apples and thorn-apples; the wineberry, the buffalo-berry and several wild cherries; the cloud-berry, prized in Labrador; the crow-berry of cold and Arctic America; the high-bush cranberry; native mulberries; opuntias and other cacti for the deserts; the paw-paw, the persimmon, and the well-known and much-used salal and salmon berries of the West and North.

"The pecan, the chestnut and the hickory-nut are the only native nuts domesticated, but some time forest and waste places can be planted not only to the nuts named, but to improved varieties of acorns, beechnuts, butternuts, filberts, hazels, chinquapins and nut-pines, to utilize waste lands, to diversify diet and to furnish articles of food that can be shipped long distances and be kept from year to year. The fad of today which substitutes nuts for meat may become a necessity tomorrow. Meanwhile it is interesting to note that the pecan has become within a few decades so important a crop that optimistic growers predict in another half-century that pecan groves will be second only to the cotton-fields in the South. A recent bulletin from the United States Department of Agriculture describes sixty-seven varieties, of which more than 1,500,000 trees have been planted."

"There are a number of native vegetables worth cultivating. The native beans and teparies in the semi-arid and subtropical Southwest to which Freeman, of the Arizona station, has called attention, grown perhaps for thousands of years by the aborigines, seem likely to prove timely crops for the dry-farmers of the Southwest. Professor Freeman has isolated seventy distinct types of these beans and teparies, suggesting that many horticultural sorts may be developed from his foundation stock. The ground-nut, *Apios tuberosa*, furnished food for the French at Port Royal in 1613, and the Pilgrims at Plymouth in 1620, and as a crop for forests might again be used. There are a score or more species of Physalis, or ground-cherries, native to North America, several of which are promising vegetables and have been more or less used by pioneers. *Solanum nigrum*, the nightshade, a cosmopolite of America and Europe, recently much advertised under several misleading names, and its congener, *Solanum triflorum*, both really wild tomatoes, are worthy of cultivation and in fact are readily yielding to improvement. *Amaranthus retroflexus*, one of the common pigweeds of gardens, according to Watson, is cultivated for its seeds by the Arizona Indians. In China and Japan the corms or tubers of a species of Sagittaria are commonly sold for food. There are several American species, one of which at least was used wherever found by the Indians, and under the name arrowhead, swan potato and swamp potato has given welcome sustenance to pioneers. Our native lotus, a species of Nelumbo, was much prized by the aborigines, seeds, roots and stalks being eaten. Sagittaria and Nelumbo furnish starting-points for valuable food-plants for countless numbers of acres of water-covered marshes when the need to utilize these now waste-places becomes pressing."

Early general writings.

The progress of horticulture may be traced in the books devoted to the subject. The earliest writings did not separate horticulture from agriculture.

It is difficult to determine the first North American book on agriculture. In 1710 "The Husbandman's Guide" was printed in Boston "by John Allen, for Eleazar Phillips." It is a small 12mo of 107 pages, in four parts. The first part contains "Many Excellent Rules for Setting and Planting of Orchards, Gardens and Woods, the times to Sow Corn, and all other sorts of Seeds." A second edition was "printed for & sold by Elea. Phillips Book-seller, in Boston, 1712." It is usual to begin the history of indigenous American book literature on agriculture with Jared Eliot, but the beginnings should have a special search. The preface to Eliot seems to indicate that he knew no writings applicable to North America. The "Essays upon Field-Husbandry," by Rev. Jared Eliot, of Killingworth, Connecticut, grandson of the famous apostle Eliot, were begun in 1748 and completed in 1759. (See "Cyclopedia of American Agriculture," Vol. IV, pp. 568, 569.) "There are sundry books on husbandry wrote in England," said Eliot, in his preface. "Having read all on that subject I could obtain; yet such is the difference of climate and Method of Management between then and us, arising from Causes that must make them always

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differ, so that those Books are not very Useful to us. Besides this, the Terms of Art made use of are so unknown to us, that a great deal they Write is quite unintelligible to the generality of New England Readers."

Just at the close of the Revolution, J. Hector St. John's "Letters from an American Farmer" appeared, although "the troubles that convulsed the American colonies had not broken out when . . . some of the . . . letters were written." For a period of twenty-five years following the close of the war the condition of our agriculture, and of all American institutions, was minutely unfolded to the world through the writings of many travelers, English and French, who made inquisitive journeys into the new country. Strickland, an English traveler, wrote in 1801 that "land in America affords little pleasure or profit, and appears in a progress of continually affording less. . . . Land in New York, formerly producing twenty bushels to the acre, now produces only ten. . . . Little profit can be found in the present mode of agriculture of this country, and I apprehend it to be a fact that it affords a bare subsistence. . . . Decline has pervaded all the states." There is abundant evidence, including a painstaking inquiry made by Washington, to show that agriculture was at a low state at the close of the century. It was in striking contrast to its status a hundred years later, notwithstanding the pessimistic writings of the later time.

There was early development of the garden desire in the South as well as in the North. In South Carolina appeared the earliest American horticultural book of which we have any record. This book is no longer extant, and it is known to this generation chiefly or wholly from the following page in Ramsay's "History of South Carolina," 1809: "The planters of Carolina have derived so great profits from the cultivation of rice, indigo [see *Indigo*] and cotton that they have always too much neglected the culture of gardens. The high price of their staple commodities in every period has tempted them to sacrifice convenience to crops of a marketable quality. There are numbers whose neglected gardens neither afford flowers to regale the senses, nor the vegetables necessary to the comfort of their families, though they annually receive considerable sums in money for their crops sent to market. To this there have been some illustrious exceptions of persons who cultivated gardens on a large scale, both for use and pleasure. The first that can be recollected is Mrs. Lamboll, who, before the middle of the eighteenth century, improved the southwest extremity of King Street [Charleston], in a garden which was richly stored with flowers and other curiosities of nature, in addition to all the common vegetables for family use. She was followed by Mrs. Logan and Mrs. Hopton, who cultivated extensive gardens in Meeting, George and King Streets, on lands now covered with houses. The former reduced the knowledge she had acquired by long experience and observation to a regular system, which was published after her death, with the title of 'The Gardener's Kalendar;' and to this day regulates the practice of gardens in and near Charlestown." Ramsay records that Mrs. Martha Logan was the daughter of Robert Daniel, one of the last proprietary governors of South Carolina. "Mrs. Logan was a great florist, and uncommonly fond of a garden. She was seventy years old when she wrote her treatise on gardening, and died in 1779, aged seventy-seven years."

Mrs. Logan's book was perhaps only a pamphlet. The first regular American gardening book, if Mrs. Logan's is excluded, is apparently Robert Squibb's "Gardener's Kalender," published in Charleston, South Carolina, in 1787 (see pp. 1520–1).

The opening of the nineteenth century may be taken as a convenient starting-point for a narrative of the evolution of American horticulture. At that time horticulture began to attain some prominence as distinct from general agriculture, and the establishment of peace after the long and depleting war with England had turned the attention of the best citizens afresh to the occupation of the soil. The example of Washington, in returning to the farm after a long and honorable public career, no doubt exerted great influence. His agricultural correspondence was large, and much of it was published at the opening of the century. His correspondence with Arthur Young and Sir John Sinclair will be found in volumes published in London in 1800 and 1801, in Alexandria in 1803, and in Washington in 1847. Details respecting the management of his plantations comprise Vol. IV of the "Memoirs of the Long Island Historical Society," 1889.

Apparently, it was not until 1790 that an indigenous and distinctly general agricultural treatise after Eliot's appeared in America. At that time, the Rev. Samuel Deane, vice-president of Bowdoin College, published his "New England Farmer, or Georgical Dictionary," a cyclopedic work of the state of American agriculture. This passed to a second edition in 1797, and to a third in 1822. As showing both the contents of this important book and the methods of reviewing of that day, the following comment is transcribed from the "Columbian Centinel," for 16th of June, 1790, printed in Boston. It is in the guise of a communication from a correspondent, as was then the custom. It must be one of the earliest reviews of an agricultural book to appear in this country:

"Nothing has been more wanting in this Country than a book of Practical Husbandry. The late Dr. Elliot of Connecticut wrote some short essays, which were well received, but it was reserved for Mr. Deane, of Portland, to give the publick *a System of Husbandy for New England*. This valuable book is now published and on perusal exceeds the expectation which had been formed of it. It is founded on solid principles of natural philosophy and practical experiment. All that is valuable in European books of husbandry is selected and accommodated to the climate and seasons of this country. Many new and curious observations are introduced; and the whole is cast in such a form and expressed in such language as must render it useful to the plain husbandman, while the enlightened naturalist will find it an agreeable entertainment.

"It not only contains a general system of agriculture, but treats of everything which usually falls under the care of the husbandman and his family, such as cattle, horses, sheep, bees, timber—gives the best directions for the care of the garden, the dairy and the cellar—and much of what is said may be extremely useful in all families where bees, cyder, fruit, milk and other necessary articles are preserved. In short it is a book which does honor to the ingenuity, and industry of its author, and deserves to be read by every person who wishes well to the best interest of this country."

In the Georgetown, South Carolina, "Gazette," March 13, 1799, is a half-column of proposals for publishing by subscription "'Notes on Agriculture adapted to the soil, climate, and markets of South Carolina,' by Louis DuPre. To be put to press as soon as 200 copies are subscribed for. Price one dollar specie." (See page 1520.)

In 1799, J. B. Bordley published in Philadelphia "Essays and Notes on Husbandry." Other early works need not be mentioned here. As early as 1785, Varlo's "New System of Husbandry" was printed in Philadelphia. It is in many ways a remarkable book, and it was written by a man who had had remarkable experiences. He was not an American, and the work first appeared in the old country; but Varlo had lived in this country, and was in sympathy with the American people. The book contained a "Farmer's and Kitchen Garden Calendar." In 1792 there appeared anonymously, from Burlington, New Jersey, the third edition of Arthur Young's "Rural Economy." He argues strongly for experiments and for the establishing of agricultural journals. This book first appeared in London, in 1770.

At the opening of the century (1800), Sir Humphry Davy had not illumined the science of agricultural chemistry, and men were even disputing as to what the food of plants is. The "burn-baking" or "devonshiring" of the land—burning the sod and scattering the ashes

over the field—was still recommended; and in 1799 James Anderson's "Essays on Quick-lime as a Cement and as a Manure," was given an American edition in Boston. It is easy to see from these facts that the fundamental conceptions of the science of agriculture were vague and crude a century ago. Near the close of the last century, Deane wrote that "the alarming effect of the present low state of husbandry is, that we are necessitated to import much of our food and clothing, while we are incapable of making proportionable remittances in the produce of the soil, or in anything else."

Green's book on flowers, published in Boston in 1828, enables us to determine what were the leading ornamental plants in that early day. The full title of the book is "A Treatise on the Cultivation of Ornamental Flowers; Comprising Remarks on the Requisite Soil, Sowing, Transplanting, and General Management; with Directions for the General Treatment of Bulbous Flower Roots, Greenhouse Plants, etc." It comprises only sixty pages. The introductory pages give general directions, then follow two annotated lists, one of annuals and biennials and the other of greenhouse plants. These lists are interesting, also, for what they do not contain. All the plants they mention are here set down, under the names and with the spelling there employed:

ANNUAL AND BIENNIAL FLOWERS.

Althæa frutex.
Almond, double-flowering.
Amaranthus superbus.
Amaranthus tricolor.
Animated oats.
Aster, China.
Auricula.
Azalea nudiflora.
Box.
Brier, Sweet.
Canterbury Bell.
Carnation.
Cassia marylandica.
Catalpa.
Cherry, double-flowering.
Chrysanthemum indicum.
Clematis, Austrian (C. integrifolia).
Clethra.
Columbine.
Convolvulus.
Corchorus japonicus.
Crocus.
Cupid's Car, or Monk's Hood (Aconitum).
Dahlia.
Daisy.
Dwarf Basil.
Egg Plant.
Eupatorium, blue.
Euphorbia Lathyris.
Fading Beauty, or Morning Bride (Scabiosa).
Fir (Pinus balsamea).
Foxglove.
Fringe Tree.
Geranium (Pelargonium).
Garden Angelica.
Glycine, cluster-flowering.
Golden Coreopsis.
Golden Everlasting (Xeranthemum, lucidum).
Hollyhock.
Honeysuckle.
Hyacinth.
Hydrangea.
Ice Plant.
Impatiens Balsamina.
Iris.
Lagerstrœmia indica.
Laurel, broad-leaved (Kalmia latifolia).
Laburnum.
Larkspur.
Lilac.
Lily.
Lime Plant (Podophyllum peltatum).
Lychnadia (Phlox).
Mezereon (Daphne mezereum).
Mountain Ash.
Musk Geranium.
Myrtle, evergreen (Vinca minor).
Narcissus.
Nasturtium.
Passion Flower.
Pæony.
Pea, sweet.
Peach, double-flowering.
Pink.
Perennial Sunflower, double.
Polyanthus.
Pyrethrum parthenium.
Poppy.
Purple Hyacinth Bean.
Roses.
Rose Acacia.
Rose-colored Hibiscus.
Rudbeckia.
Scarlet Cacalia.
Scarlet Lynchis (L. chalcedonica).
Siberian Crab.
Snow-ball Tree.
Snowberry.
Spice-wood (Laurus Benzoin).
Spiderwort (Tradescantia).
Spirœa.
Syringa, or Mock Orange.
Strawberry Tree (Euonymus).
Sweet Bay (Laurus nobilis).
Sweet William, or Poetic Pink.
Tulip.
Venetian Sumac, or Fringe Tree.
Violet, blue fragrant.

GREEN HOUSE PLANTS.

Lilies of the valley.
Ranunculuses.
Anemones.
Single and Double Jonquils.
White Lilies.
Roses.
Tuberoses.
Persian Iris.
Mignionette.
Verbena trifoliata, or Sweet Vervain.
Fuhsia coccinea.
Cobœa scandens.
Camellia japonica, or Japanese Rose.
Myrtles (Myrtus communis).

These lists are much less ample than those of M'Mahon, over twenty years earlier, but they may be supposed to include the popular and most easily grown things. They will be suggestive to those who wish to make "old-fashioned gardens." M'Mahon's list was evidently largely compiled from European sources. Green says that the first list (strangely called "annual and biennial flowers") contains "such plants, shrubs and trees as are of easy cultivation, generally hardy." The second list comprises "a few different sorts of green house plants" "which are commonly grown in rooms."

The early writings clearly portray the tendencies of the floricultural interests,—from the formal-flower ideals of the dahlia and camellia to the enormous development of the cut-flower interest, and the growth within the last few years of the greater love of plants themselves. Palms and decorative plants are now almost household necessities, whereas seventy-five years ago they would have been luxuries. "There has been a radical change in the character of the flowers used for cut-flower purposes," wrote Alfred Henderson in 1895. "Fifty years ago, camellia flowers retailed freely for a dollar each, and during the holidays Philadelphia used to send thousands to New York florists, getting $500 per 1,000; while roses went begging at one-tenth these figures. Now, the rose is queen, and the poor camellia finds none so poor to do her reverence. . . . . I confidently believe that the time is not far distant when we shall compete seriously with the foreign grower in the production of new varieties of roses." William Scott, of Buffalo, in 1900 made the following comments on floriculture: "About the year 1880, tulips and narcissuses began to be forced, and during the next fifteen uears immense quantities of these bulbs were imported annually from Holland. As the methods of forcing were perfected the market became overstocked, and, although large quantities are still forced for the winter and spring months, they are not now in the same favor as formerly, and the rose, carnation, violet, lily-of-the-valley and mignonette are still the favorites. Orchids are not yet the flower for the million, but there is a yearly increasing demand for them, and at present the showy orchids, such as the Cattleyas and Lælias, are far short of the demand. As their cultivation is more generally understood, we look for a very steady increase in the number grown, and are confident that the supply will not soon exceed the demand. Within the past five or six years a marked increase is noticeable in the use of plants to adorn the home, and the demand is for an expensive class of plants,—palms, dracenas, araucarias and ferns being among those mostly used. Now few homes with any pretension to luxury or even comfort are without a few fine plants scattered through the rooms, and many of our modern houses are provided with either a bay window or small conservatory for the accommodation of plants." (See *Cut-Flower Industry* and *Floriculture*.)

America has not been favored with horticultural annuals to the extent equally with England and other countries. The first attempt of the kind seems to have been Woodward's "Record of Horticulture," edited by A. S. Fuller, which appeared in 1866 and 1867. The next venture was the "American Horticultural Annual," New York, for the years 1868 ,1869 and 1870, under the general editorial care of George Thurber. The attempt was not made again until the "Annals of Horticulture," was issued by Bailey, in 1889, and which was published for five years, the last volume containing an account of the horticulture of the Columbian Exposition.

Fruit-growing in particular.

Horticulture, in its commercial aspects, was nothing more than an incidental feature of farm management at the opening of the century. In fact, it is only in the past generation that the field cultivation of horticultural crops has come to assume any general importance in the rural economy of the nation. And even

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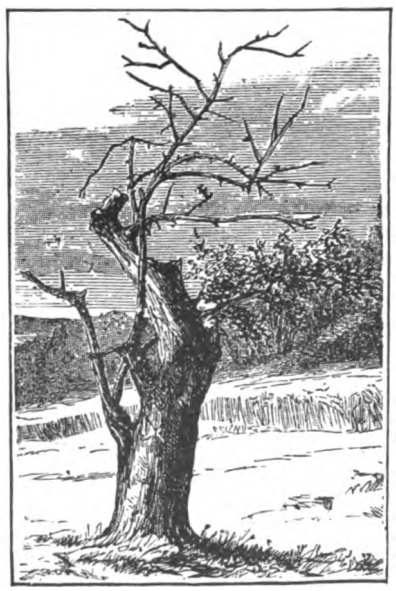
now, horticultural operations which are projected as a fundamental conception of land occupation are confined to relatively few parts of the country. It is only in certain regions or with certain persons that the farmer starts out with horticulture as a base, and with grain and stock and hay as accessories; and even in these places, many horticulturists are still drawing their practices and the reasons for them from the operations of general mixed agriculture. The history of fruit-growing in most of the older parts of North America is the history of the apple, and the subject is developed under that heading; but before proceeding to the apple specially we may pause to consider some of the dates in the extension of fruit-growing westward.

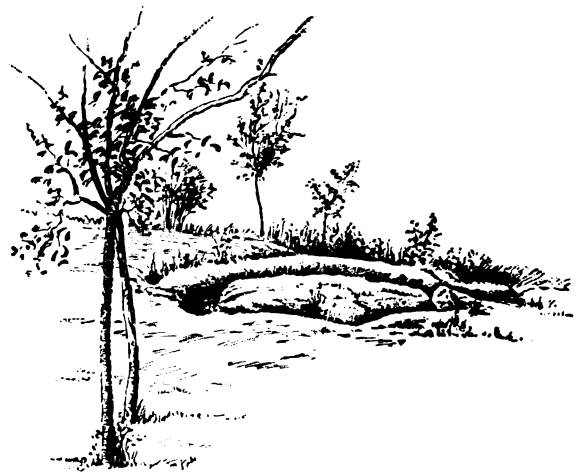
"It may not occur to many of our people," writes Charles W. Garfield, "that the horticulture of Michigan may have had its beginning as early as that of Massachusetts, as the French Jesuit missionaries visited Detroit the same year that the Mayflower landed its pilgrims at Plymouth Rock." The influence of the French missionaries must be well considered when the history of American horticulture is written, particularly of those parts that lie along the great waterways. The old pear trees along the Detroit River and in eastern Michigan attest the early French dissemination. The first planting of orchards in Michigan, according to Garfield, "were made at Detroit from stock secured across the river, the stock having originally come from France to Montreal, and progressed westward with the settlements. The varieties were Fameuse, Pomme Grise, and Red and White Colville." The first large importation of orchard trees was made about 1825, the stock having come from Grant Thorburn of New York. The spread of tree-planting to the westward followed regularly with the progress of settlement.

The above remarks about the Jesuits indicate that the early American fruit-growing was not all derived from British sources. Much of the influence was certainly French; on the Pacific coast and probably in parts on the southern borders of the present United States it was Spanish. It would be interesting to try to trace the influence of the Dutch and other colonizers.

The reader who desires to trace the beginnings of fruit-planting in some of the territory from Nebraska south and southwest should consult the "Proceedings of the American Pomological Society" for 1905 (pages 74-98). In Nebraska, apples were planted in 1853. It appears that in Kansas apple-tree planting has been recorded near Shawneetown, Johnson County, as early as 1827 by Rev. Thomas Johnson, the variety being the Newtown Pippin. In 1836, he planted pear trees. In Arkansas, J. B. Russell, of Cane Hill, had a small nursery of apple trees in 1835. A little after this date, Isaac Shannon originated the apple that bears his name. Before the close of the seventeenth century, the French at St. Genevieve, Missouri, had planted pears, grapes and a few apples. In New Mexico, the agricultural industry developed to some extent under Spanish rule, and continued under the Mexican rule from 1822 to 1845, but little reference is made to fruit. It is recorded that the Bishop of Santa Fé, early introduced apricots and apples from the States, and John Clark planted apple trees from Missouri in Rio Arriba County in 1859.



1853. Relic of early days—apple tree at probably 250 years.



1854. Bartram's cider-mill, a relic of the last century.

It is said that the apples were placed in the circular groove in the rock and crushed by means of a weight rolling over them. The juice ran out the gutter at the farther side and was caught in a rock-hewn cistern.

The development of fruit-growing in the Northwest is sketched for this occasion by C. I. Lewis. The first authentic introducton of fruit into the Pacific Northwest (of the United States) was in 1824, when seed was brought from England by members of the Hudson Bay Company. This seed was planted near what is now Vancouver, Washington, then a trading-post of the Hudson Bay Company. Seeds of apples, grapes, pears, and peaches were planted. The apple trees which resulted from this seed are still standing on government lands occupied by the Vancouver barracks. There were other introductions by various persons, but they probably had no influence on the growth of the fruit industry in the Northwest. In 1847, Henderson Lewelling, of Iowa, brought several hundred yearling grafted sprouts of mixed fruits. The same year William Meek brought a sack of apple seed and a few grafted trees. These two men established the first nursery in the Pacific Northwest at Milwaukee, Oregon, and laid the foundation of our commercial fruit industry. In the following ten or fifteen years, many men brought trees and seed, and nurseries were started. From 1850 to 1870, fabulous prices were received for fruit, one box of apples selling for $75, while in 1855, 6,000 bushels of apples sold for prices ranging between $20 and $30 a bushel. The period between 1850 and 1870 also marked the introduction of plums and prunes into the Northwest country. The first Italian prune orchard was set in 1858 by Seth Lewelling. Between 1870 and 1890 was a period of decline. The former demand from California ceased and railroads were few, the freight rates being exorbitant. Beginning early in the 1890's the fruit industry of the Northwest began to revive. About 1900, the apple industry began to recover. In 1896, the Lambert cherry was introduced commercially, and has proved to be the greatest commercial cherry

for shipping. J. R. Cardwell has been the principal historian of Northwest horticulture. He came out in the early days of the fruit industry and is still living. He has been very influential in building up the fruit industry in the Pacific Northwest.

The apple.

There was practically only one general horticultural commodity, at least in the northern states, a hundred

1855. An early cider-mill in Pennsylvania.

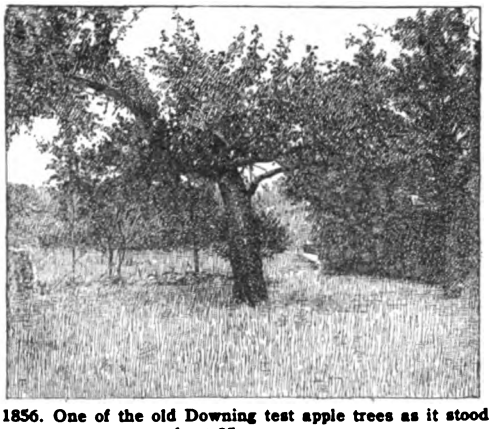
years ago, and that was the apple. Pears, peaches, cherries, quinces and some other fruits were common, but there was little thought of marketing them. Even the apple was an incidental or even an accidental crop. Little care was given the trees, and the varieties were few, and they were rarely chosen with reference to particular uses, beyond their adaptability to cider and the home consumption. In parts of the East, very ancient apple-tree relics still stand, some of them perhaps existing from Colonial times (Fig. 1853).

Thacher, writing from Plymouth in 1821, says that "the most palpable neglect prevails in respect of proper pruning, cleaning, and manuring round the roots of trees, and of perpetuating choice fruits, by engrafting from it on other stocks. Old orchards are, in general, in a state of rapid decay; and it is not uncommon to see valuable and thrifty trees exposed to the depredations of cattle and sheep, and their foliage annoyed by caterpillars and other destructive insects. In fact, we know of no branch of agriculture so unaccountably and so culpably disregarded." Were it not for the date of Thacher's writing, we might mistake this picture for one drawn at the present day.

If one may judge from the frequent and particular references to cider in the old accounts, it does not seem too much to say that this sprightly commodity was held in greater estimation by our ancestors than by ourselves. In fact, the cider barrel seems to have been the chief and proper end of the apple. Of his thirty chapters on fruit-growing, Coxe (1817) devotes nine to cider, or forty-two pages out of 253. John Taylor's single epistle devoted to horticultural matters in the sixty and more letters of his "Arator" is upon "Orchards," but it is mostly a vehement plea for more cider. "Good cider," he says, "would be a national saving of wealth, by expelling foreign liquors; and of life, by expelling the use of ardent spirits." In Virginia, in Taylor's day, apples were "the only species of orchards, at a distance from cities, capable of producing sufficient profit and comfort to become a considerable object to a farmer. Distilling from fruit is precarious, troublesome, trifling and out of his province. But the apple will furnish some food for hogs, a luxury for his family in winter, and a healthy liquor for himself and his laborers all the year. Independent of any surplus of cider he may spare, it is an object of solid profit and easy acquisition." As early as 1647, twenty butts of cider were made in Virginia by one person, Richard Bennet. Paul Dudley writes of a small town near Boston, containing about forty families, which made nearly 3,000 barrels of cider in the year 1721; and another New England town of 200 families, which supplied itself with "near ten Thousand Barrels." Bartram's cider-mill, as it exists at the present day, is shown in Fig. 1854. An old mill in Pennsylvania is shown in Fig. 1855. It is a ponderous pine log, more than three feet through, raised and lowered by means of a great screw. "These presses" according to C. F. Shaw, "were 'neighborhood' affairs in cider-making time and the farmers would rise very early that they might reach the press before their neighbors, and so not have to wait long before their turn to have their cider made." It was not until well into the past century that people seem to have escaped the European notion that fruit is to be drunk. Jarvis writes (1910) of Connecticut conditions that in "the first half of the last century many commerical orchards of modest size were in existence, but they were composed mostly of seedling trees or 'native fruit,' the product of which was used largely in the manufacture of cider."

There have been several marked alternations of fervor and neglect in the planting of apples since the first settlement of the country. Early in the eighteenth century there appears to have been a great abundance of the fruit; but in 1821 Thacher declared that "it is a remarkable fact that the first planters bequeathed to their posterity a greater number of orchards, in proportion to their population, than are now to be found in the old colony," and he attributes the decline in orcharding largely to the encroachment of the "poisonous liquor" of the later times. Under the inspiration of Thacher, Coxe, Kendrick, Prince, Manning, and the Downings, orchards were again planted, and later there was another period of decline in the East, following the aging of these plantations. Two reminders of the Downings are shown in Figs. 1856 and 1857, made from photographs taken by the writer some twenty or more years ago.

Apple trees were very early planted in the New World. On Governor's Island, in Boston harbor, a few apples were picked in 1639. Trees were carried far into the frontiers by the Indians and probably also by the French missionaries, and the "Indian apple orchards" are still known in many localities even east of the Mississippi (see, also, *Appleseed, Johnny* page, 1563). At the opening of the nineteenth century, the Early Harvest, Newtown Pippin, Swaar, Spitzenburg, Rhode Island Greening, Yellow Bellflower, Roxbury Russet, and other familiar apples of American origin were widely disseminated and much esteemed. Apples had begun to be planted by settlers in Ohio before 1800. In 1817, Coxe could recommend a list of "one hundred kinds of the most estimable apples cultivated in our coun-



1856. One of the old Downing test apple trees as it stood about 25 years ago.

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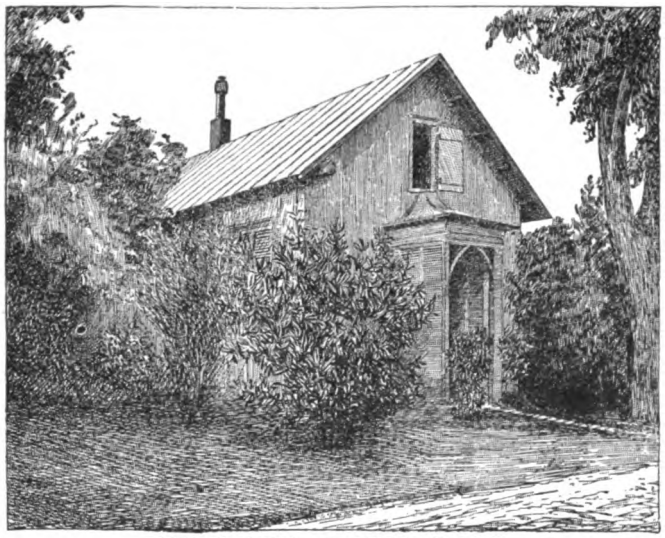
try;" and in 1825 William Prince offered 116 varieties for sale—at 37½ cents a tree—of which seventeen were set aside—after the custom of the time—as particularly adapted to the making of cider. Of these 116 varieties, sixty-one were considered to be of American origin. In 1872, Downing's list of apples which had been fruited and described in America, had swollen to 1,856 varieties, of which 1,099 were of known American origin. Of this great inventory, probably not over one-



1857. The fruit-house of Charles Downing.

third were actually in cultivation at any one time, and very many of them are now lost. In 1892, the trade-lists showed that 878 varieties were actually offered for sale by the nurserymen of North America.

The style of illustration in these old books is well displayed in Fig. 1858, from Coxe, original size.

There has been a noticeable tendency toward the origination of varieties of apples in this country, and the consequent exclusion of varieties of European origin. As early as 1760, cions of American varieties were sent to England. Before the Revolution, apples were exported. The origination of indigenous varieties was, of course, largely accidental, and was a necessary result of the method of growing apple trees directly from seeds, and top-grafting them in case they should turn out profitless. A critical study of American horticulture will show that all species of plants which have been widely cultivated in this country have gradually run into indigenous varieties, and the whole body of our domesticated flora has undergone a progressive evolution and adaptation without our knowing it. By far the greater number of the apples of the older apple-growing regions of the country are indigenous varieties, and the same process is now operating in the Northwest, where the American seedlings of the Russian stock are proving to be more valuable than the original importations.

Pears were amongst the earliest fruits introduced into the New World, and the French, particularly, disseminated them far and wide along the waterways, as witnessed by the patriarchal trees of the Detroit River and parts of the Mississippi system (p. 1512). Bartram's Petre pear (Fig. 1851) is one of the patriarchs of the last century, although the tree is not large. The first American book devoted exclusively to the pear was Field's, published in 1859. The Japanese type of pears had been brought into the country from two and perhaps three separate introductions, early in the fifties, but they had not gained sufficient prominence to attract Field's attention. From this oriental stock has come a race of promising kinds represented chiefly by the Kieffer, LeConte and Garber.

Peaches were early introduced into the New World by various colonists, and they thrived so well that they soon became spontaneous. Nuttall found them naturalized in the forests of Arkansas in 1819, and the species now grows in waste and forest lands from Georgia and the Carolinas to the westward of the Mississippi. There is probably no country in which peaches grow and bear so freely over such a wide territory as in North America. The old Spanish or Melocoton type is now the most popular race of peaches, giving rise to the Crawfords and their derivatives.

Of late years there has been a contraction of some of the original peach areas, and many good people have thought that the climate is growing uncongenial, but it is only the natural result of the civilization of the country and the change in methods. Peaches had never been an industry, but the orchards were planted here and there as very minor appendages to the general farming. For generations insect pests were not common. There were no good markets, and the fruit sold as low as 25 cents a bushel from the wagon-box. In fact, the fruit was grown more for the home-supply than with an idea of shipping it to market. Under such conditions, it did not matter if half the crop was wormy, or if many trees failed and died each year. Such facts often passed almost unnoticed. The trees bore well, to be sure; but the crop was not measured in baskets and accounted for in dollars and cents, and under such conditions only the most productive trees left their impress on the memory. The soils had not undergone such a long system of robbery then as now. When the old orchards wore out, there was no special incentive to plant more, for there was little money in them. Often the young and energetic men had gone West, there to repeat the history perhaps, and the old people did not care to set orchards. And on this contracting area, all the borers and other pests which had been bred in the many old orchards now concentrated their energies, until they have left scarcely enough trees in some localities upon which to perpetuate their kind. A new country or a new industry is usually free of serious attacks of those insects that follow the crop in older communities. But the foes come in unnoticed, and for a time spread unmolested, when finally, perhaps almost suddenly, their number becomes so great that they threaten destruction, and the farmer looks on in amazement.

Oranges.—The orange is another tree that has thrived so well in the new country that the spontaneous thickets of Florida, known to be descendants of early Spanish introductions, are supposed by residents to be indigenous to the soil.

As to oranges and similar fruits on the Pacific coast, Coit writes in "Citrus Fruits" (1915) as follows: "Citrus seeds were first brought into California from the peninsula of Lower California, where peoples of Spanish descent have cultivated various kinds of European fruit trees and vines since the year 1701. In 1768 the Jesuit missionaries were supplanted by the Franciscans, some of whom under the leadership of Junipero Serra pushed northward into the territory which is now the state of California. These hardy pioneers founded the first Mission in Upper California at San Diego in 1769, and proceeding northward established a chain of Missions extending 400 miles along the coast, the last being established at Somoma in 1823."

Plums and cherries.—The progress of the plum in America nearly equals that of the grape in historic interest. The small spontaneous plums, known as

Damsons, the offspring of introductions from Europe, were early abundant in New England. Plum-culture has never thrived far south of Mason and Dixon's line or west of Lake Michigan, except, of course, on the Pacific slope and parts of the far southwestern country. There are climatic limitations which more or less restrict the area of plum-growing, and the leaf-blight fungus, black-knot, and fruit-rot have added to the perplexities. In these great interior and southern areas various native plums, offshoots of several indigenous species, have now spread themselves, and they have already laid the foundation of a new type of plum-culture. The first of these novel plums to receive a name was that which we now know as the Miner, and the seed from which it sprung was planted by William Dodd, an officer under General Jackson, in Knox County, Tennessee, in 1814. The second of these native plums to come into prominence, and the one which really marks the popularization of the fruit, is the Wild Goose. Some time before 1830, it is related, a man shot a wild goose near Columbia, Tennessee, and where the remains were thrown this plum sprang forth. It was introduced to the trade about 1850, by the late J. S. Downer, of Fairview, Kentucky. Over 200 named varieties of these native plums are now described, and some of them are widely disseminated and deservedly popular. In the South and on the plains, these natives are a prominent horticultural group. The complexity of the cultivated plum flora is now further increased by the introduction of the Japanese or Chinese type, which first came in by way of California in 1870. Finally, about 1880, the apricot plum, or *Prunus Simonii*, was introduced from China by way of France; and the American plum industry, with no less than ten specific types to draw upon and which represent the entire circuit of the northern hemisphere, is now fairly launched upon an experimental career which already has produced remarkable results.

The cherry was early introduced from Europe. In 1641 trees were planted in Virginia in the orchard of Governor Berkeley. As early as 1663 it was grown in Massachusetts. The commercial cherries of this country are derived from the same species as those of Europe, although the dwarf sand-cherry of the Plains has been improved or cultivated to some extent.

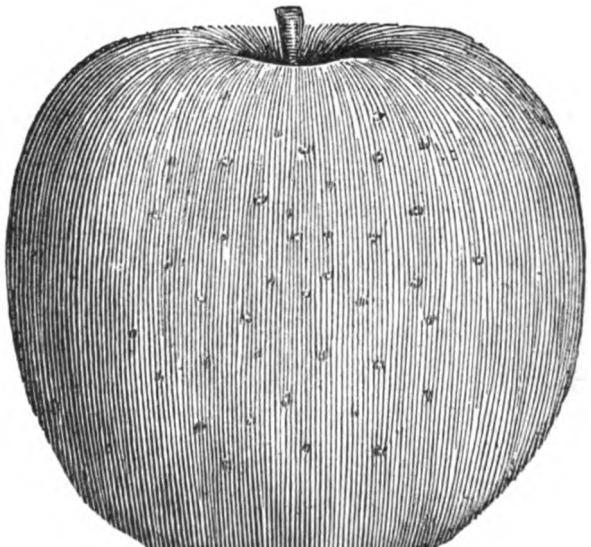
Grapes.—In America, no crop has been the subject of so much book-writing as the grape. Counting the various editions, no doubt a hundred books have appeared, being the work of at least fifty authors. Since the American grape is a product of our own woods within about a century, the progress in grape-growing has been ahead of the books. Most of the books are founded largely on European advice, and therefore are not applicable to American conditions. In general pomology, the books seem to have had much influence upon fruit-growing; but in the grape the books and actual commercial grape-growing seem to have had little relation one to the other. Some of the later books have more nearly caught the right point of view.

The grape of North America is of two unlike types,—the natives, which comprise all commercial outdoor varieties in the interior and eastern states; and the vinifera or Old World kinds, which are grown under glass and in California. The native types were developed within the nineteenth century. The oldest commercial variety is the Catawba, which dates from 1802; the cosmopolitan variety the Concord, which first fruited in 1849 (see p. 1374). A full review of the history is made in "Evolution of Our Native Fruits." With the first settlement of the country, efforts were made to grow the European wine-grape. Thus in 1619 vine-dressers and vines were sent from France to Virginia; the subsequent history of the wine-grape in North America is a record of repeated attempts and continuous failures; and these failures, due largely to phylloxera and mildew, finally forced the cultivation of the native species of Vitis. In Mexico and on the Pacific slope, however, the wine-grape established itself readily about the missions, and it is now the foundation of the grape-culture of California. It is very likely that these introductions of the padres preceded those in the eastern American colonies.

A very interesting error appears to have crept into North American history in connection with the native grapes. The "wineberry" found by the Norsemen on the American coast in the eleventh century has prevailingly been identified as grapes, and this interpretation has made it apparent that the explorers came south as far as the present New England. Recently, however, M. L. Fernald has concluded (Rhodora, xii, 17–38, Feb., 1910), that the wineberries of the Norsemen were certainly not grapes, but most likely the mountain cranberry, *Vaccinium Vitis-Idæa*.

To show how far we have come in grape-culture, the examples in Fig. 1859 will be interesting. This cut is from S. W. Johnson's "Rural Economy," 1806, published in New Jersey. It shows the method with the European wine-grape. Just twenty years later appeared Dufour's book on the grape; he also represents a foreign method (Fig. 1860).

Strawberry.—There was no commercial strawberry-culture in America, worthy of the name, until the introduction of the Hovey (Fig. 1861) late in the thirties of last century. This and the Boston Pine were seedlings of C. M. Hovey's, Cambridge, Massachusetts. They first fruited in 1836 and 1837, and from them are supposed to have descended many of the garden strawberries of the present day. These were seedlings of the old Pine type of strawberry, which is apparently a descendant of the wild strawberry of Chile. The Wilson, or Wilson's Albany, which originated with John Wilson, of Albany, New York, began to attract



1858. Example of the earliest illustrations of American fruits. Esopus Spitsenberg, figured by Coxe in 1817.

attention about 1856 or 1857, and it marked the beginning of the modern epoch in American strawberry-growing. In the Middle West, strawberry-growing was given a great impulse by Longworth and Warder.

Bramble fruits.—Raspberries were grown in North America in the eighteenth century, but they were of the tender European species, of which the Antwerps were the common types. This type of raspberry is now almost wholly superseded by the offspring of the

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native red and black species, which first began to impress themselves upon cultivation about 1860.

The blackberry, an indigenous American fruit, first commended itself to cultivation with the introduction of the New Rochelle or Lawton, toward the close of the 1850's. The first named variety of native blackberry of which we have any record was the Dorchester, which was exhibited before the Massachusetts Horticultural Society in 1841.

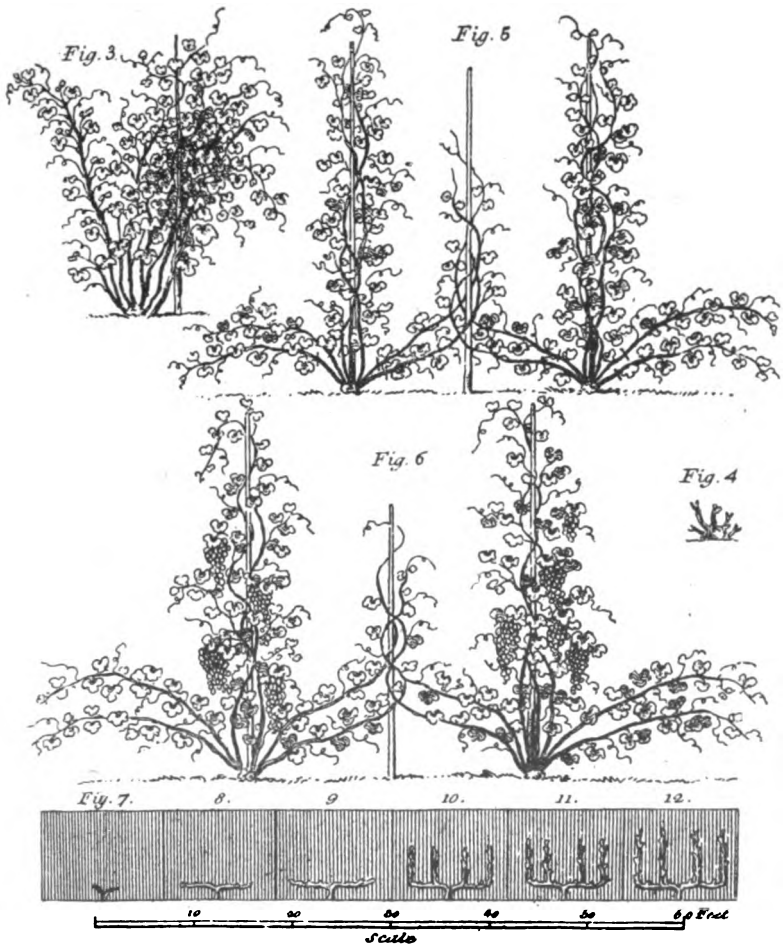
The dewberry, a peculiarly American fruit, first appeared in cultivation early in the 1870's in southern Illinois under the name of the Bartel, which is a large form of the common wild dewberry of that region. It was first brought to the attention of the public in 1875. The following year the Lucretia, the most popular of dewberries, was introduced into Ohio from West Virginia, where it had been found wild some years before by a Union soldier.

Gooseberries.—The history of the gooseberry in America recalls that of the grape. It is a characteristic fruit of England and the Low Countries, and it was early introduced into America. But, like the European grapes, the gooseberries were attacked by a fungous sickness which rendered the cultivation precarious. An improved form of the native species must be introduced, and this was accomplished by Abel Houghton, of Massachusetts, who, from the seed of the wild berry, produced the variety which now bears his name (Fig. 1862). This variety began to attract some attention a little previous to 1850, although it was not planted freely until several years later. From seed of the Houghton sprang the Downing, still the most popular gooseberry in America, although Houghton is still much grown from Philadelphia south; and our gooseberry-culture is, therefore, but two removes from nature. With the advent of the bordeaux mixture and its related specifics, however, the English gooseberries are again coming to the fore. Hybrids of the English and American types, as in the Triumph or Columbia and the Chautauqua, may be expected to become more popular for home use and special markets, but the Americans will probably remain in favor for general market purposes.

The cranberry, most singular of American horticultural products, was first cultivated, or rescued from mere wild bogs, about 1810. Its cultivation began to attract attention about 1840, although the difficulties connected with the growing of a new crop did not begin to clear away until about 1850. Cape Cod was the first cranberry-growing region, which was soon followed by New Jersey, and later by Wisconsin and other regions. The varieties now known are over a hundred, and the annual product from tame bogs in North America is now upward of 1,000,000 bushels.

The nursery and seed business.

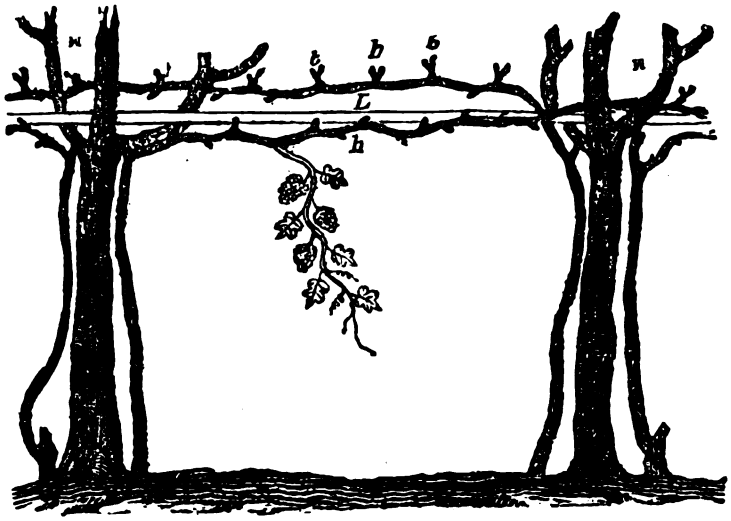
It is impossible to fix a date for the beginning of the nursery business in North America. Trees were at first grown in small quantities as an adjunct to general farm operations. Gov. John Endicott, of the Massachusetts Colony, was one of the best fruit-growers of his time, and he grew many trees. In 1644, he wrote to John Winthrop as follows: "My children burnt mee at least 500 trees this Spring by setting the ground on fire neere them;" and in 1648 he traded 500 apple trees, three years old, for 250 acres of land. The first nursery in Maine is thought by Manning to have been that of Ephraim Goodale, at Orrington, established early in the present century. Other early nurserymen of Maine were the brothers Benjamin and Charles Vaughan, Englishmen, who settled at Hallowell in 1796. An early nursery in South Carolina was established by John Watson, formerly gardener to Henry Laurens, before the Revolution. In Massachusetts, there were several small nurserymen toward the close of the eighteenth century, amongst others, John Kenrick, of Newtown, whose son William wrote the "New American Orchardist," published in 1833, and which passed through at least eight editions. The trees were usually top-grafted or budded, sometimes in the nursery and sometimes after removal to the orchard. Deane writes in 1797, that "the fruit trees should be allowed to grow to the height of 5 or 6 feet before they are budded or grafted." Stocks were sometimes grafted at the crown, and even root-grafting was known, although it is generally said that this operation originated with Thomas Andrew Knight, in 1811. It is probable, however, that the root-grafting of the eighteenth century was only grafting



1859. An early American picture of grape-training (1806).

at the surface of the ground, and that it had little similarity to the method now in vogue.

One of the new trees something over one hundred years ago was the Lombardy poplar. John Kenrick had two acres devoted to it in 1797; and Deane writes, in 1797. that "the Lombardy poplar begins to be planted



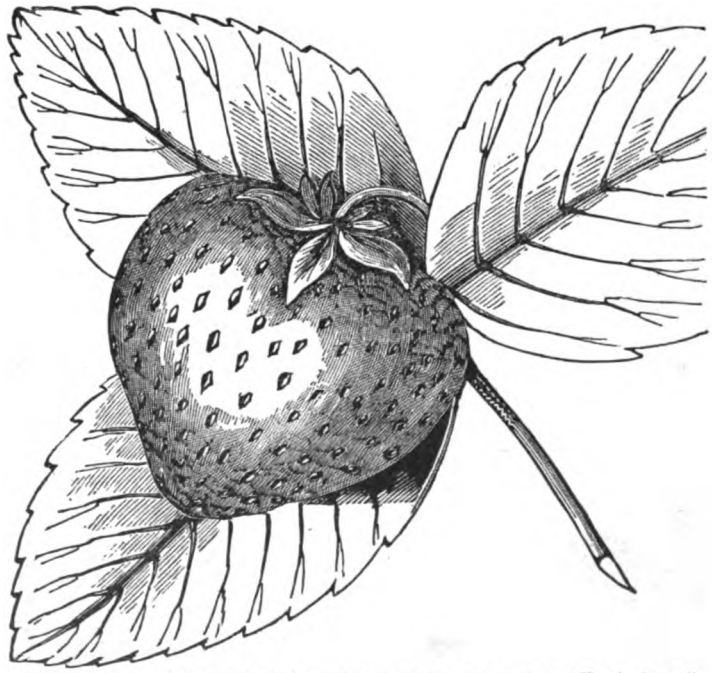
1860. Dufour's picture of grape-training (1826). Patterned after the South-European fashion of employing mulberry trees for supports.

in this country. To what size they will arrive, and how durable they will be in this country, time will discover." He does not mention it in the first edition, 1790. The tree is said to have been introduced into America by William Hamilton, of Philadelphia, in 1784, although Mr. Meehan wrote that he remembered trees over sixty years ago that seemed to be a century old.

Manning quotes a bill of sale of nursery stock in 1799, showing that the price of fruit trees was 33⅓ cents each. Deane speaks of raising apple trees as follows: "The way to propagate them is by sowing the pomace from cydermills, digging, or hoeing it into the earth in autumn. The young plants will be up in the following spring; and the next autumn, they should be transplanted from the seed-bed into the nursery, in rows from 2 to 3 feet apart and 1 foot in the rows, where the ground has been fitted to receive them." Nothing is said about grafting the trees in the nursery.

The first independent general nursery in the New World, in the sense in which we now understand the term, appears to have been that established by William Prince at Flushing, Long Island, and which was continued under four generations of the same family. The founder was William Prince. The second Prince was also William, the son, and author of the first regular American treatise on horticulture, 1828. The third generation was William Robert Prince. He was the author of "A Treatise on the Vine" (1830), "The Pomological Manual" (1831), and "Manual of Roses" (1846). In the first two he was aided by his father, the second William. This William Robert Prince is the one who first distinguished the types of the prairie strawberry into the two species, *Fragaria illinoensis* and *F. iowensis*. From a large catalogue of William Prince, second, published in 1825—and which contains, amongst other things, lists of 116 kinds of apples, 108 of pears, 54 of cherries, 50 of plums, 16 of apricots, 74 of peaches and 255 of geraniums—the following account is taken of the founding of this interesting establishment: "The Linnæan Garden was commenced about the middle of the last century by William Prince, the father of the present proprietor, at a time when there were few or no establishments of the kind in this country. It originated from his rearing a few trees to ornament his own grounds; but finding, after the first efforts had been attended with success, that he could devote a portion of his lands more lucratively to their cultivation for sale than to other purposes, he commenced their culture more extensively, and shortly after published a catalogue, which, at that early period, contained several hundred species and varieties, and hence arose the first extensive fruit collection in America." The elder Prince died in 1802, "at an advanced age." In October, 1790, a broadside was issued in New York, printed by Hugh Gaine, giving a list of a large collection of fruit trees and shrubs for sale by William Prince at Flushing Landing, on Long Island. The twenty-second edition of this broadside appeared in 1823. In Thomas "History of Printing," second edition, reference is made to an edition printed in 1771.

Amongst the nurseries which were prominent from 1820 to 1830 were Bloodgood's, Floy's, Wilson's, Parmentier's, and Hogg's, near New York; Buel and Wilson's at Albany; Sinclair and Moore's, at Baltimore. David Thomas, a man of great character, and possessed of scientific attainments, was an early horticulturist of central or western New York. His collection of fruits at Aurora on Cayuga Lake, was begun



1861. The original picture of the Hovey strawberry. "Magazine of Horticulture," August, 1840. (Original size)

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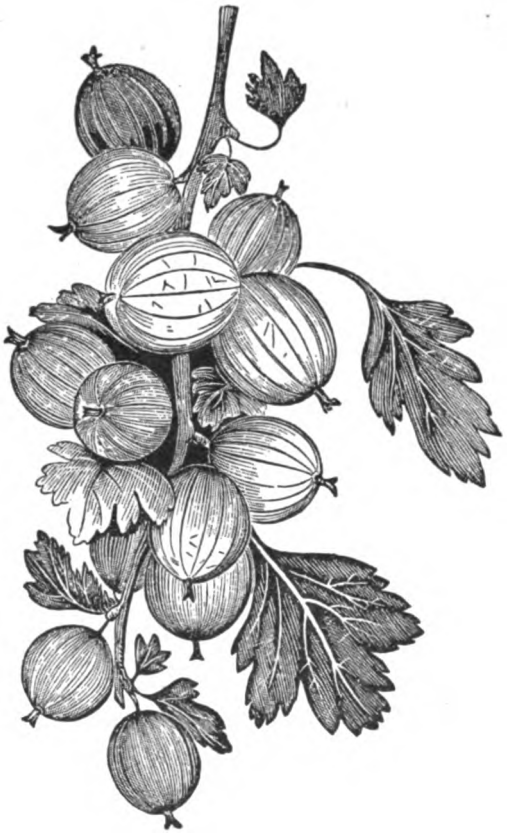
about 1830. His son, John J. Thomas, nurseryman and author of the "American Fruit Culturist," which first appeared in 1846, died at a ripe old age in 1895. The nursery of Thomas Hogg, referred to above, was an important establishment. In a "Catalogue of the ornamental trees and shrubs, herbaceous and green-



1862. The original picture of the Houghton gooseberry.
From the "Horticulturist" for September, 1868. (Original size)

house plants, cultivated and for sale by Thomas Hogg, nurseryman and florist," 1834, there are sixteen small pages, double columns, of mere lists of species and varieties, comprising no less than 1,200 entries of great variety. These were offered at "The New York Botanic Garden in Broadway, near the House of Refuge." The first Thomas Hogg, an Englishman, procured land in 1822 in upper Broadway (where Twenty-third Street now is), and began business as florist and nurseryman. In 1840 they were removed to Seventy-ninth Street and East River, and here the sons, Thomas and James, assisted the father, who died in 1855. Later, James had a garden at the foot of Eighty-fourth Street, and here he grew many plants sent from Japan, by his brother Thomas, who resided and traveled in that country (page 1580).

The nursery firm of Parsons & Co., on Long Island, was founded in 1838. It was instrumental in distributing great quantities of fruit and ornamental stock at a formative time in American horticulture, and it was a pioneer in several commercial methods of propagation of the more difficult ornamental stock. It was a leading distributor of Japanese plants in the early days. Between 1840 and 1850 arose the beginnings of that marvelous network of nurseries, which, under the lead of Ellwanger & Barry, T. C. Maxwell & Brothers, W. & T. Smith, and others, has spread the name of western New York throughout North America. In 1857, Prosper J. Berckmans, who had then been a resident of the United States seven years, removed to Georgia, and laid the foundation of the very important business now conducted by his sons.

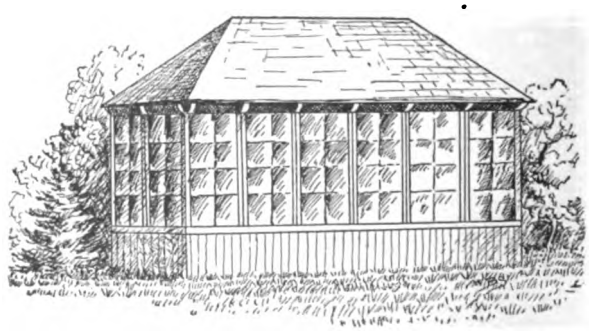
The oldest American seed house, David Landreth's, in Philadelphia, was established in 1784. Another was John Mackejohn's, 1792; others, William Leeson, 1794, and Bernard M'Mahon, 1800, all of Philadelphia. In 1802, Grant Thorburn's was established in NewYork, the first catalogue of four pages being published then. The first and last of these businesses still exist under the family names. M'Mahon did a large business in exporting seeds of native plants, and it was through his work that many American plants came into cultivation in Europe. His catalogue of seeds of American plants in 1804, for the export trade, contained about 1,000 species of trees, herbs and shrubs. He also announced at that time that he had "also for sale an extensive variety of Asiatic, South Sea Islands, African and European seeds of the most curious and rare kinds." "The prices shall be moderate, and due allowance will be made to those who buy to sell again." M'Mahon, through business and writing, had great influence on American horticulture in its formative period. He distributed seeds of the very important Lewis and Clark expedition; but Landreth is said to have shared these seeds, and also those collected by Nuttall. Those were days of the enthusiastic exportation of the seeds of American plants.

The development of the seed trade is coincident with the development of the postal service. Burnet Landreth writes that "it was not until 1775 that the New York city post office was first established, the mail passing once every two weeks between New York and Boston. In 1775, a through mail was established by Postmaster Franklin between Boston and Savannah, the letters being carried by post riders, each man covering 25 miles. Previous to that date, sixty days would frequently pass without a mail from Virginia."

The number of seed firms in North America is now in the hundreds. With the development of the plant-breeding enterprises, local or regional firms and associations are springing up, to do commerce with particular strains or lines of breeding. The demand for good seeds, with recognized merit, is one of the most hopeful developments in American agriculture. It is of the same order of excellence as the demand for pedigreed and well-bred live-stock.

Greenhouses.

The first glasshouse in North America was probably erected early in the century before last, in Boston, by Andrew Faneuil, who died in 1737. This house passed to his nephew, Peter Faneuil, who built Faneuil Hall. The greenhouse which is commonly considered to be the first built in the country was erected in 1764 in New York, for James Beekman. A picture of this, from Taft's "Greenhouse Construction," is shown in Fig.



1863. One of the earliest American greenhouses (1764).

1863. Glasshouses were fully described in 1804 by Gardiner and Hepburn, and in 1806 by M'Mahon, but these authors do not state to what extent such structures existed in America. In Doctor Hosack's botanic garden, 1801, extensive glasshouses were erected, Compare Figs. 1749 and 1750. Fig. 1864 shows one of the earliest American pictures of a greenhouse. It is copied, full size, from Squibb's "Gardener's Calendar," Charleston, South Carolina, 1827. Fig.

1864. Greenhouse front.

With glass lights and door of glass at the end, to be 7 feet high, 35 in length by 12 in breadth. Brick foundation 2 feet high, half a foot of which to be underground.—Robert Squibb, "Gardener's Calendar," Charleston, S. C. (1827).

1865 shows the first greenhouse in Chicago, as illustrated in "American Florist." Note the small panes, and the sash-construction. This was built in 1835 or 1836. With these pictures should be compared the modern greenhouses as shown in Fig. 1866; also in the pictures in the articles on *Greenhouse*.

These early houses were heated by flues or fermenting substances. The use of steam in closed circuits began in England about 1820. Hot-water circulation seems to have been a later invention, although it drove out steam heating, until the latter began to regain its supremacy in this country thirty to forty years ago. The "New England Farmer" for June 1, 1831, contains a description of hot-water heating for hothouses, a matter then considered to be a great novelty.

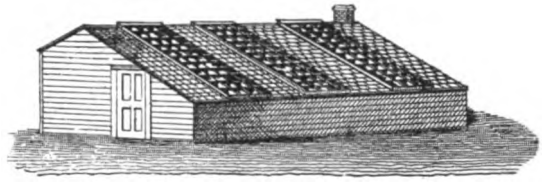
Most of the early houses had very little, if any, glass in the roof, and the sides were high. It was once a practice to build living-rooms over the house, so that the roof would not freeze. In the "modern" construction of the greenhouse of M'Mahon's day, 1806, he advised that "one-third of the front side of the roof, for the whole length of the house, be formed of glasswork," and in order that the tall, perpendicular sides of the house should have as "much glass as possible," he said that "piers between the sashes are commonly made of good timber, from 6 to 8 or 10 inches thick, according to their height." "The width of the windows for the glass sashes may be 5 or 6 feet; . . . the bottom sashes must reach within a foot or 18 inches of the floor of the house and their top reach within 8 or 10 inches of the ceiling." The panes in the roof should be 6 inches by 4, this size "being not only the strongest, but by much the cheapest, and they should lap over each other about ½ inch." But the sides or "front lights must be made with large panes of glass." Many or most of the early plant-houses had removable tops, made of sash. On the change from the old to the new ideas, Alfred Henderson writes as follows: "The first published advocacy of the fixed-roof system was made by Peter B. Mead, in the 'New York Horticulturist,' in 1857. Before that, all greenhouse structures for commercial purposes were formed of portable sashes, and nearly all were constructed as 'lean-tos,' with high back walls, and none were connected. All were separate and detached, being placed at all angles, without plan or system. Then, too, the heating was nearly all done by horizontal smoke-flues, or manure fermenting, although there was a crude attempt at heating by hot water by some private individuals as early as 1833. The first use of heating by hot water on anything like a large scale, however, was in 1839, when Hitchings & Co., of this city, heated a large conservatory for Mr. William Niblo, of New York; and yet for nearly twenty years after this time heating by hot water was almost exclusively confined to greenhouses and graperies on private places, as few professional florists in those days could afford to indulge in such luxuries. All this is changed now. The use of steam, hot water under pressure, and the gravity system of hot-water heating are almost universally in operation, the hot-air flue having been relegated to the past. The best evidence of progress is in the fact that the florist has not waited for the tradesman, but has brought about these improvements himself."

Much attention was early given to the slope of the roof, in order that the greatest amount of sunlight may be secured. Early in the past century the curvilinear roof came into use, as the various angles which it presents to the sun were supposed to catch the maximum number of the incident rays. The sides of the house remained high, for the most part, until near the middle of the century. All this shows that the early glasshouse was modeled after the dwelling or other buildings, and that it had not developed into a structure in which plants were grown for commercial purposes.

The modern commercial forcing-house, with direct roof, low sides, and heated by steam or hot water in closed circuits, is mostly a development of the last forty years. Its forerunner was the propagating-pit of the nurseryman. If anything is lost in sunlight by adopting a simple roof, the loss is more than compensated by the lighter framework and larger glass. In the forcing-house, all architectural ambition is sacrificed to the one desire to create a commercial garden in the frosty months.

Lettuce, cucumbers, tomatoes, carnations, violets, and various other plants are now grown as crops under glass roofs, whereas a generation ago they were usually not forced at all for market or were grown mostly under frames. With the simplifying and cheapening of the glasshouse, amateur flower- and vegetable-growing has acquired a new impetus, and the business of the retail florist has grown amazingly.

Some idea of the increase of the demand for plants may be obtained from the sale of flower-pots. A. H. Hews, of Cambridge, Mass., whose ancestors began the manufacture of pots before 1765, once reported that for a period of twenty-two years, from 1788 to 1810 the accounts of the sales of pots "cover about as many pages as we now often use in one day; and the amount in



1865. First greenhouse in Chicago (1835 or 1836).

dollars and cents does not compare with single sales of the year 1894." He also compared the sales for 1869 and 1894 and "found the increase as ten to one; or, in round numbers, 700,000 flower-pots in the former year and 7,000,000 in the latter; and if the same factory can in 1920, twenty-five years later, produce and sell 70,000,000, we shall verily be living in a land of flowers."

One of the earliest greenhouse builders was Frederic A. Lord, who built his first houses, according to Taft,

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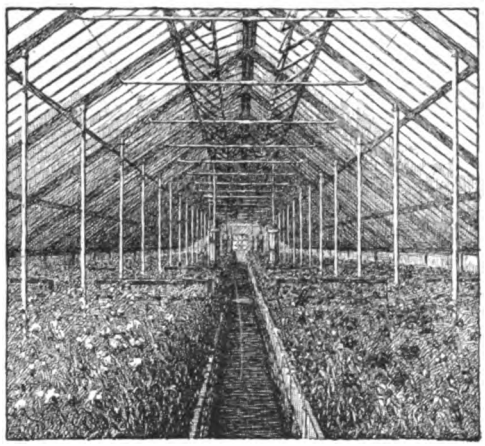
in Buffalo in 1855, and who, in 1872, entered into partnership with W. A. Burnham, at Irvington, on the Hudson. Several firms now make greenhouse building and heating a specialty. In very recent years a new impetus has been given to glasshouse building and work by the establishment of the agricultural experiment stations and the extension of horticultural teaching in the colleges.

The growing literature.

An important feature of American horticulture is its living literature. Persons may care nothing for books; yet the literature of any subject is the measure of its ideals. Persons may say that the books are theoretical and beyond them; yet good books are always beyond, else they are not good. There is no reason for literature if it does not inspire and point to better things. We measure the aspirations of any time by its writings. Whether the fact be recognized or not, the literature of our horticulture is an underlying force which slowly dominates the thoughts and ideals of men. A book is a powerful teacher. It states its propositions, and is silent; and in the silence its lessons sink into the mind.



1866. Interior of a modern commercial greenhouse.—Carnations.

Very many books have enriched American horticulture. Many of them have been poor, but even these may have challenged controversy and have done good. The early books were largely empirical and dogmatic. Downing, for example, in 1845, says that tillage makes better orchards, and he cites cases; but he does not give reasons. He does not mention nitrogen, potash, soil moisture, chemical activities. He does not even mention plant-food in connection with tillage. The horizon has widened since then. Men do not take up things actively until they know the reasons. The poor farmer, not knowing reasons for anything, has no inspiration and goes fishing. Forty years ago, Colonel Waring was the apostle of deep-plowing; yet one should plow neither deep nor shallow until he knows why. Our literature has been singularly devoid of principles and analysis. The great writer is he who catches the significant movements and ideas of his time and portrays them to inspire his reader. Henderson first caught the rising commercial spirit of our vegetable-gardening; his "Gardening for Profit" was the greatest American vegetable-gardening book, even if now out of date as a book of practice. American pomology has several strong names amongst its writers. Most of these writers have sacrificed fundamental considerations to varieties. The first sustained effort to write on fruit-growing from the point of view of underlying principles was by Charles R. Baker, who in 1866 published his "Practical and Scientific Fruit Culture." But the time was apparently not yet ready for a solid book of this kind, and much of the discussion lacked vital connection with the orchard. The book was suggestive of the study and the compiler. Coxe, Kenrick, Manning, Downing, Thomas, Warder, Barry, Fuller, are significant names in American pomological literature. In floriculture there have been many excellent treatises, but there is not yet a single great or comprehensive book. In recent years, the making of technical horticultural literature is passing more and more from the working horticulturist to the specially trained student and writer, particularly to those who are connected with colleges of agriculture and experiment stations. At the same time, the amateur and strictly popular writings are increasing rapidly, and the modern publisher has made many of the books very attractive in their mechanical execution.

The periodical literature is not to be overlooked, although we do not now have in America horticultural magazines and journals comparable with those of Europe. These serial writings, however, are voluminous and important, and must be taken into account when any complete estimate is made of American horticultural literature. On the writing of "gardening literature," Henry Ward Beecher wrote nearly fifty years ago: "We, in America especially, need men to write who devote time, thought and knowledge to this elegant department of knowledge as they do to the sciences of law, of medicine, or theology; and, although we are glad of transient and cursory writing, rather than none, I feel the want, in American horticultural magazines, of writing that is the result of long and close observation, and of ripe reflection." L. H. B.

HORTICULTURE, LITERATURE OF. The written record of American horticulture has not yet been carefully studied, although the collecting of books has lately assumed much interest and importance. There are no full lists of these writings; and it is to make a preliminary contribution to such lists that the present compilation is presented. The written word persists long after the word of mouth has been lost; and it admits of no doubt as to dates and statements of fact. It is essential that any people arrive at an appreciation of its records in a given subject, that it may have perspective and develop sound judgments.

In the preceding pages something has been said about the development of writing on horticulture in North America. The early general writings are discussed beginning on page 1509. The fruit-growing literature is reviewed from page 1513. The periodical literature occupies considerable space, beginning page 1559. The reports of horticultural societies are recorded from page 1553. In the present discussion, the regularly printed horticultural books are listed in detail, from the first book on horticulture in North America, so far as it may be known, to the current date. In the preceding accounts, some of the early writings on general agriculture are discussed, as bearing on the history; many other early writers might have been mentioned, if the subject had taken a wider field, as Binns (Frederick, Maryland, 1803), Spurrier (Worcester, 1792), Parkinson (Philadelphia, 1799), George Logan (Philadelphia, 1797), Du Pre ("Culture of Cotton," 1799, perhaps the book mentioned on page 1510), and others.

North American horticultural books.

In the introduction to the "History of the Massachusetts Horticultural Society" (1880) it is said that Mrs. Martha Logan, in South Carolina, "when seventy years old, wrote a treatise on gardening called the 'Gardener's Kalendar,' which was published after her death in 1779, and as late as 1808 regulated the practice of gardening in and near Charleston. She was a great florist, and uncommonly fond of a garden" (page 1510). In the Charleston library there is no separate

book of this kind, but the "Gardener's Calendar by Mrs. Logan" appears in succeeding issues of the "Carolina and Georgia Almanac," comprising six pages. The earliest date there available is in the Almanac for 1798. It has been spoken of as a pamphlet, and it may have been reprinted separately. The first almanac printed in South Carolina was Tobler's for 1752. This almanac contains a "Gardner's Kalender, done by a Lady of this Province and esteemed a very good one." Perhaps this work was by Mrs. Logan. There does not appear to be any book by Mrs. Logan in the antiquarian libraries or lists, although, following Allibone, Evans apparently erroneously included it in Vol. IV of his "American Biblography" as of the date of 1772. Mrs. St. Julien Ravenel, in "Charleston, the Place and the People" (1906), writes that "Mrs. Logan was the daughter of the gallant Colonel Daniel. Her 'Gardeners' Chronicle,' written when over seventy, was in great demand formerly, but seems to have utterly perished, the most careful search failing to produce a copy."

The almanacs were important mediums of information in the early days, and it is probable that some of the first instruction in horticulture was given in them. In "Poor Will's Almanack" for 1787, printed in Philadelphia in 1786, there is a "Gardener's Kalender; or useful memorandums of work necessary to be done, monthly, in the gardens and orchards of the Middle States," according to Evans. The "Southern States Ephemeris" for 1788, printed in Charleston in 1787, contains "a new and copious gardener's calendar" for the southern states. In Isaac Brigg's "Georgia and South Carolina Almanac" for 1800, printed in Augusta in 1799, there is a calendar, according to Evans, by Robert Squibb. The agricultural matter in the New England almanacs is well known.

In 1796, there was printed at Newburyport, Massachusetts, by Blunt and March, for John Dabney, Salem, "An Address to Farmers" on a number of interesting subjects. It contains a part or chapter on the character of a complete farmer; one on the profits of a nursery; another on the advantages of an orchard. There are references in the appendix to apples, barley, cabbages, carrots, clover, and other subjects. The parts were "extracted principally from a variety of authors."

Apparently the earliest separate book on a horticultural subject published in North America (if the Logan is not counted), was Robert Squibb's "The Gardener's Kalender for South Carolina and North Carolina," published in Charleston in 1787, and again in 1809, 1827, and 1842 (Fig. 1864). The second work appears to be an American edition of Marshall's "Introduction to the Knowledge and Practice of Gardening," Boston, 1799. The second indigenous horticultural book, apparently, appeared in 1804, "The American Gardener," by John Gardiner and David Hepburn (Fig. 1867). It was published at Washington. This book had an extensive sale. It was revised by "a citizen of Virginia," and republished in Georgetown, D.C., in 1818 (see Hepburn, p. 1579). A third edition appeared in 1826.

This book was followed in 1806 by Bernard M'Mahon's excellent and voluminous "American Gardener's Calendar," in Philadelphia. This work enjoyed much popularity, and the eleventh edition appeared as late as 1857. For fifty years it remained the best American work on general gardening. M'Mahon, remembered in the Mahonia barberries, was an important personage. He was largely responsible for the introduction into cultivation of the plants collected by Lewis and Clark. These early books were calendars, giving advice for the successive months. They were made on the plan then popular in England, a plan which has such noteworthy precedent as the excellent "Kalendarium Hortense" of John Evelyn, which first appeared in 1664, and went to nine regular editions. Other early books of this type were "An old gardener's 'Practical American Gardener,'" Baltimore, 1819 and 1822; Thorburn's "Gentleman's and Gardener's Kalendar," New York, the third edition of which appeared in 1821.

As throwing some light on the processes of bookmaking in those days, the following announcement by Squibb in the "Charleston Evening Gazette," July 4, 1786, will be interesting:

To the Public.

From the frequent solicitations of a number of Gentlemen of this and adjoining states, the subscriber has been induced to undertake a work, entitled, "The South Carolina, Georgia, and North Carolina Gardeners Calendar," which, from its general utility, he flatters himself, will meet the approbation of the Public at large. The English publications hitherto made use of to point out and direct the best methods of Gardening by no means answer the purpose, as they tend to mislead instead of instruct, and suit only the European parts for which they were designed.—This work is deduced from practice and experience in this climate, wherein the most certain and simple methods are clearly pointed out, so as to render the art of Gardening easy and familiar to every capacity.

The work will be comprised in an octavo volume of about 200 pages, which will contain ample directions for whatever is necessary to be done in the Kitchen and Fruit Garden for every month in the year.

Terms of subscribing One Dollar; half on subscribing, the remainder on the delivery of the book, which will be printed with all possible dispatch. Robert Squibb Nursery and Seedsman.

Subscriptions will be received at the subscriber's Garden, the upper end of Tradd street, at the Printers of this Paper, at Bower & Markland's Printing-office, Church street, and at the principal Taverns.

The first indigenous book written on the topical plan, treating subject by subject, is apparently Coxe's fruit book, 1817; the second appears to have been Cobbett's "American Gardener," published at New York in 1819,

THE

AMERICAN GARDENER,

CONTAINING AMPLE DIRECTIONS FOR WORKING

A KITCHEN GARDEN,

EVERY MONTH IN THE YEAR;

And copious instructions for the cultivation of

FLOWER GARDENS, VINEYARDS, NURSERIES, HOP-YARDS, GREEN HOUSES, AND HOT HOUSES.

BY JOHN GARDINER & DAVID HEPBURN,

Late Gardener to Gov. Mercer & Gen. Mafon.

CITY OF WASHINGTON

PRINTED BY SAMUEL H. SMITH,

FOR THE AUTHORS.

1804.

1867. Title-page, exact size, of what is supposed to be the second or third indigenous American horticultural book.

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in London in 1821, and which passed through subsequent editions. This William Cobbett is the one who edited the federalist paper in Philadelphia known as "Peter Porcupine's Gazette," and whose attack upon Dr. Rush's treatment of yellow fever brought against him a judgment for damages, and which decided him to return to England in 1800, whence he had come, by way of France, in 1792. In London he again took up political writing, and in 1817 he retreated to America to escape political penalties, and resided upon a farm on Long Island until 1819. He kept a seed store in New York in 1818, and we find Grant Thorburn disputing with him in the "Evening Post" as to which sold the better rutabaga seed at one dollar a pound. Cobbett, it seems, claimed to have been the introducer of this vegetable, also known as the Russian turnip, into this country; but Thorburn retorts that "in the year 1796 a large field of these turnips was raised by Wm. Prout on that piece of ground now occupied by the navy yard, at the city of Washington." He completed his life in England, becoming a voluminous author upon political and economical subjects. It is interesting to note, in connection with this dispute about the turnips, that the kohlrabi was introduced about the same time, and Deane says of it in 1797, that "whether this plant, which has but newly found its way into our country, is hardy enough to bear the frost of our winters, I suppose is yet to be proved." It was recommended to be grown as a biennial, which accounts for Deane's fear that it might not pass the winters.

Fessenden's "New American Gardener," made upon the topical plan, appeared in Boston in 1828, and went to various editions; and from this time on, gardening books were frequent. Some of the leading early authors are Thomas Bridgeman, of New York; Robert Buist, of Philadelphia, and Joseph Breck, of Boston.

The first American book devoted wholly to flowers was probably Roland Green's "Treatise on the Cultivation of Flowers," Boston, 1828 (p. 1511). Edward Sayers published the "American Flower Garden Companion," in Boston, in 1838. From 1830 to 1860 there appeared many of those superficial and fashionable books which deal with the language of flowers, and which assume that the proper way to popularize botany is by means of manufactured sentiment.

The first book devoted to a special flower was probably Sayers' treatise on the dahlia, Boston, 1839, which appeared only a year later than Paxton's well-known book in England. Sayers' book also included the cactus. The next special flower-book seems to have been Buist's "Rose Manual," Philadelphia, 1844, although a sentimental book on the "Queen of Flowers" had appeared in the same city in 1841. Buist's book went to at least four editions. It was followed by Prince's in 1846, and by S. B. Parson's "The Rose: Its History, Poetry, Culture and Classification," 1846. Parson's book went to a revised edition. Of later-date flower-books there are several of importance, but it is not the purpose of this paragraph to trace more than the beginnings of American floricultural writings.

In 1838 appeared a book in French in New Orleans. This was Lelievre's "Nouveau Jardinier de la Louisiane." It was a small book of 200 pages, with a calendar and brief directions for the growing of vegetables, fruits and flowers. Singularly enough, a French book also appeared at the other extreme of the country. This was Provancher's "Le Verger-Canadien," published in Quebec in 1872.

It is in the pomological writings that North America has made the greatest contributions to horticultural literature. William Forsyth's excellent "Treatise on the Culture and Management of Fruit Trees" appeared in London in 1802, and it was widely read, "an impression of 1,500 copies (of the first edition) in 4to having been sold in a little more than eight months." An American edition, by William Cobbett, appeared in New York and Philadelphia in 1802, and in Albany in 1803, and an epitome of it by "an American farmer," was published in Philadelphia in 1803. The first American pomological book was William Coxe's "View of the Cultivation of Fruit Trees," published in Philadelphia in 1817, a work known to students of horticultural literature for the uniform completeness and accuracy of its descriptions. A feature of this excellent work are the many woodcuts of varieties of fruits. Although not answering the requirements of the present day, they were considered to be very good for the time and for a new country. One of them is reproduced in Fig. 1858 to show the style of workmanship. Coxe had 100 woodcuts of apples, 63 of pears, 15 of peaches, 17 of plums, 3 of apricots, 2 of nectarines. This makes 200 engravings, which would be considered liberal illustration even at the present day.

James Thacher's "American Orchardist" appeared in Boston in 1822, and the second edition at Plymouth in 1825. The first edition was also bound with William Cobbett's "Cottage Economy," and the double volume was issued in New York in 1824 as "American Orchardist and Cottage Economy." "The Pomological Manual," New York, 1831 (second edition 1832), is a compilation of descriptions of varieties, by William Robert Prince and William Prince, son and father respectively. William Kendrick's "New American Orchardist" was published in Boston in 1833. The eighth edition appeared in 1848. Like all early works, it devotes most of its space to varieties. Robert Manning published his admirable "Book of Fruits," at Salem, in 1838, being aided by John M. Ives. Upon the death of Manning, Ives published a second edition in 1844 under the title of "The New England Fruit Book," and a third in 1847 as "The New England Book of Fruits." Downing's "Fruits and Fruit Trees of America" appeared in 1845 in two forms, duodecimo and octavo, although both issues were printed from the same type. One issue of the octavo form contained colored plates. Thomas' "Fruit Culturist," which is known in subsequent editions as "The American Fruit Culturist," appeared in 1846. Other pomological writings which appeared before 1850 are Sayers' "American Fruit Garden Companion," Boston, 1839; Hoffy's "Orchardist's Companion," Philadelphia, 1841; Bridgeman's "Fruit Cultivator's Manual," New York, 1845; Floy's American edition of George Lindley's "Guide to the Orchard and Fruit Garden," New York, 1846; Jaque's "Practical Treatise on the Management of Fruit Trees," Worcester, 1849; Goodrich's "Northern Fruit Culturist," Burlington, Vt., 1849; Cole's "American Fruit Book," and others. Barry's "Fruit Garden" appeared in 1851.

Of these pomological books, the first place should be given to those of Coxe, Kendrick, Manning, Downing, Thomas and Barry. The influence of Downing's "Fruits and Fruit Trees of America" probably has been greater than that of all others in extending a love of fruits and a critical attitude toward varieties. Begun by Andrew Jackson Downing—perhaps the fairest name in American horticultural literature—it was continued and revised by the elder brother, Charles, after the untimely death of the former. Most of these works were largely compilations. A notable exception was Manning's "Book of Fruits." In the introductory remarks to this volume is the following statement: "There is one circumstance to which we venture to call the attention of our readers—that while some recent works on pomology are compiled from earlier authors, or from information derived at second-hand, the writers themselves seldom having the means of observation in their power, we have in these pages described no specimen which we have not actually identified beyond a reasonable doubt of its genuineness." It was Manning who chiefly made known to Americans the pears of the Belgian, Van Mons. He was one of the most careful observers amongst American pomologists.

The awakening pomology of the region west of the Alleghanies found expression in Elliott's "Fruit Book," 1854, whose author wrote from Cleveland, and which went to a new edition in 1859 as "The Western Fruit Book," with the preface dated at St. Louis; and Hooper's "Western Fruit Book," 1857, written at Cincinnati. John A. Warder was a guiding spirit of the opening West.

The earliest separate grape book was published in Washington in 1823, by the prophetic Adlum, "A Memoir on the Cultivation of the Vine in America." This went to a second edition in 1828. Before this time (1806), S. W. Johnson had devoted much space to the grape in his "Rural Economy," published at New Brunswick, N. J., and he published interesting pictures of grape-training (Fig. 1859). Adlum's book was followed in 1826 by the "American Vine Dresser's Guide," by Dufour. This important work also gave pictures of grape-training, one of which is reproduced in Fig. 1860. The larger number of the grape books appeared before the close of the Civil War, although the larger part of the development of the subject has taken place since that time.

LIST OF AMERICAN HORTICULTURAL BOOKS

The purpose of the following list is to record all the regular publishers' or book-trade books, and their editions, on fruit-growing, flower-growing, vegetable-gardening, and closely related subjects, that have been published in the United States and Canada to the close of the year 1914. It does not include British or other imported books that apparently are printed abroad and then bound up in this country with a new title-page, or even those of foreign authorship that are merely reprinted in this country, for the reason that they do not represent American experience and are really not American works. Neither does the list contain all excerpts or separates of articles or addresses that may be put in pamphlet form, nor the reports and publications of government departments. Revisions and modified editions, as indicated by new copyright or changed title-page, are included, but not new impressions or re-issues.

The entries comprise the name of the author (or editor) as given on the title-page, the exact title, the phraseology of the subtitles, whether illustrated, place of publication, date (n. d. means that no date is given on the title-page), date of copyright (n. c. means that there is no copyright imprint), publisher, number of pages (roman numerals are those of prefatory pages), and size of the bound volume to one-quarter of an inch. It is intended that the capitalization and punctuation of the original shall be followed, but as the list has been compiled from several sources it has been impossible to be consistent in these details. The name of the author is intended to be given in the form in which it appears in the given book, on the assumption that the author's wishes and usage are to be respected.

Every pains has been taken to make this list accurate and complete. It was first put in type more than two years ago, and it has been gone over by many persons. Revised proofs have been taken and these have again been gone over. Special aid has been given by the Library of the United States Department of Agriculture, Library of Congress, and the Massachusetts Horticultural Society.

ABBOTT, FRANCIS B. Hand-Book of Small Fruits. Illus. Chicago, Ill. n. d. Paper 5¼ x 3½. [1889?]

ADAMS, H. S. Flower Gardening. Illus. New York. 1913. [c. 1913.] McBride, Nast & Co. 253 pp. 5 x 7½.

———. Lilies. Being one of a series of flower monographs. Illus. New York, 1913. [c. 1913.] McBride, Nast & Co. 116 pp. 5 x 7.

———. Making a Rock Garden. Illus. New York. 1912. [c. 1912.] McBride, Nast & Co. 52 pp. 6½ x 4¼. (House and Garden Making Books.)

ADLUM, JOHN. A Memoir on the Cultivation of the Vine in America, and the Best Mode of Making Wine. Washington. 1823. [c. 1823.] Davis & Force. 142 pp.

———. The same. 2d ed. Washington. 1828. [c. 1828.] William Greer. 180 pp.

AGAR, MADELINE. Garden Design in Theory and Practice. Illus. Philadelphia. 1912. J. B. Lippincott Company. 272 pp. 9 in.

AGRICOLA, P. The New York Gardener; or, twelve letters from a farmer to his son, in which he describes the method of laying out and managing the kitchen garden. White Creek. 1827. [n. c.] Published by A. Crosby. G. M. Davison, Printer, Saratoga Springs. 96 pp. 7 x 4½.

ALBAUGH, BENJAMIN F. The Gardenette; or, City Back Yard Garden by the Sandwich System . . . a complete Guide for the Amateur Gardener. Illus. Piqua, O. 1912. The Magee Bros. Co., Printers. 64 pp. 9 in.

ALBEE, HELEN R. Hardy Plants for Cottage Gardens. Illus. New York. 1910. H. Holt & Co. vi + 309 pp. 8 in. (American Nature Series. Group IV. Working with Nature.)

ALDERMAN, W. H. See Hedrick, U. P. The Plums of New York.

ALLEN, C. L. Bulbs and Tuberous-rooted Plants; their history, description, methods of propagation and complete directions for their successful culture in the garden, dwelling and greenhouse. Illus. New York. 1893. [c. 1893.] Orange Judd Company. vi + 311 pp. 8 x 5½.

———. Cabbage, Cauliflower and Allied Vegetables from Seed to Harvest. Illus. New York. 1901. [c. 1901.] Orange Judd Company. xvi + 127 pp. 7½ x 5.

ALLEN, JOHN FISK. The Culture of the Grape. Embracing Directions for the Treatment of the Vine, in the Northern States of America, in the open air, and under glass structures, with and without artificial heat. Illus. Boston. 1847. Dutton & Wentworth, Printers. 55 pp. 9¼ in.

———. A Practical Treatise on the Culture and Treatment of the Grape Vine; embracing its history, with directions for its treatment, in the United States of America, in the open air, and under glass structures, with and without artificial heat. Illus. 2d ed., enlarged. Boston. 1848. [c. 1848.] Dutton & Wentworth. 247 pp.

———. The same. Illus. 3d ed., enlarged and revised. New York. 1853. [c. 1853.] C. M. Saxton, Barker & Co. 330 pp. 7¾ x 5½.

———. Victoria Regia; or, the great water lily of America. With a brief account of its discovery and introduction into cultivation. With illustrations by William Sharp, from specimens grown at Salem, Mass., U. S. A. Colored plate. Boston. 1854. [c. 1854.] Dutton & Wentworth. 17 pp. 27 x 21.

ALLEN, LEWIS F. Rural Architecture; being a complete description of farmhouses, cottages, and outbuildings, comprising wood houses, workshops, tool houses, carriage and wagon houses, stables, smoke and ash houses, ice-houses, apiary or bee house, poultry houses, rabbitry, dovecote, piggery, barns and sheds for cattle, etc., together with lawns, pleasure grounds and parks; the flower, fruit and vegetable garden; also, useful and ornamental domestic animals for the country resident, etc.; also, the best method of conducting water into cattle yards and houses. Beautifully illustrated. New York. 1863. [c. 1852.] C. M. Saxton. 378 pp. 8 x 5.

———. The same. A. O. Moore; also by Orange Judd & Co. 7½ x 5.

———. See Smith, C. H. J. Landscape Gardening.

ALLEN, PHOEBE, and GODFREY, DR. Miniature and Window Gardening. New York. 1902. J. Pott & Co. 100 pp. 7½ in.

ALLEN, WALTER FOX. English Walnuts; what you need to know about planting, cultivating and harvesting this most delicious of nuts. Illus. Lawrenceville, N. J. [c. 1912.] W. F. Allen. 29 pp. 6½ in.

ALWOOD, WM. B. A series of bulletins on Orchard Technique. Bulletins 97–101, Virginia Agricultural Experiment Station. With notes on insecticides by J. L. Phillips and H. L. Price. Illus. Roanoke, Va. 1900. Stone Printing and Manufacturing Company. 125 pp. "Orchard Technique" on cover.

AMERICAN CHRYSANTHEMUM ANNUAL, 1895. See Barker, Michael.

AMERICAN FLORIST COMPANY'S DIRECTORY of Florists, Nurserymen and Seedsmen of the United States and Canada. Chicago. 1890. [c. 1890.] Published by the American Florist Company. 123 pp. 8¼ x 6.

———. The same. 1892. 195 pp.
———. The same. 1894. 270 pp.
———. The same. 1896. 335 pp. 7½ x 4¾.
———. The same. 1898. 351 pp.
———. The same. 1899. 358 pp.
———. The same. 1900. 384 pp.
———. The same. 1901. 397 pp.
———. The same. 1902. 416 pp.
———. The same. 1903. 415 pp.
———. The same. 1904. 407 pp.
———. The same. 1905. 451 pp.
———. The same. 1906. 475 pp.
———. The same. 1907. 496 pp.
———. The same. 1908. 507 pp.

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———. The same. 1909. 544 pp.

———. The same. 1910. 566 pp.

———. The same. 1911. 586 pp.

———. The same. 1912. 645 pp.

AMERICAN FRUITS POCKET DIRECTORY for the year 1910. Rochester, N. Y. 1910. American Fruits Publishing Company. 168 pp. 6¾ x 3½.

AMERICAN FRUITS YEAR BOOK AND DIRECTORY OF NURSERYMEN for the year 1912. Portraits. Rochester, N. Y. [c. 1912.] American Fruits Publishing Company. 190 pp. 7¼ x 4.

AMERICAN HORTICULTURAL ANNUAL. A yearbook of horticultural progress for the professional and amateur gardener, fruit-grower, and florist. Illus. New York. 1867. [c. 1867.] Orange Judd Company. 152 pp. 7½ x 5.

———. The same, for 1868. 164 pp.

———. The same, for 1869. 152 pp.

———. The same, for 1870. 152 pp.

———. The same, for 1871. 152 pp.

AMERICAN ROSE CULTURIST, THE. Being a practical treatise on the propagation, cultivation, and management of the rose in all seasons; with a list of choice and approved varieties adapted to the climate of the United States. To which are added full directions for the treatment of the dahlia. Illustrated with engravings. New York. n. d. [c. 1856.] Orange Judd Company. 96 pp. 7¼ x 5.

———. The same. 1866. [c. 1852.] C. M. Saxton & Co. 96 pp. 8 x 5½. (Bound sixth in Saxton's Rural Handbook, 2d series.)

———. The same. 1866. [c. 1856.] Orange Judd Company. 96 pp. 7¼ x 5.

ANDERS, J. M. House-Plants as Sanitary Agents; or, the relation of growing vegetation to health and disease; comprising, also, a consideration of the subject of practical floriculture, and of the sanitary influences of forests and plantations. Philadelphia. 1887. [c. 1886.] J. B. Lippincott Company. 334 pp. 7¾ x 5.

ANDERSON JAMES. See Marshall, Charles. An Introduction to the Knowledge and Practice of Gardening.

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———. The same. 2d ed., revised and enlarged. 1891. [c. 1889.] viii + 599 pp. 9 x 6.

———. The same. 3d ed., largely rewritten. 1900. [c. 1899.] Pacific Rural Press. viii + 477 pp. 9 x 6.

———. The same. 4th ed., revised and extended. 1909. [c. 1908.] 433 pp. 10¾ in.

———. The same. 5th ed., revised and extended. 1910. 604 pp. 9½ in.

———. The same. 6th ed., fully revised. 1912. [c. 1912.] 602 pp.

———. The same. 7th ed., fully revised. 1914. [c. 1914.] 513 pp.

———. The California Vegetables in Garden and Field. A manual of practice, with and without irrigation, for semi-tropical countries. Illus. San Francisco. 1897. [c. 1897.] Pacific Rural Press. viii + 336 pp. 9 x 6.

———. The same. 2d ed., revised and extended. 1910. 367 pp. 9½ in.

———. The same. 3d ed., revised and extended. 1913. 326 pp.

WIGHT, J. B. Pecans: the what, when, how of growing them. Illus. Cairo, Ga. 1906. 15 pp. 9 in.

WILCOX, JOHN. Peach Culture. A complete treatise for the use of peach growers; comprising the experiences of many of the largest growers in the country, describing the best mode of cultivation and how to ward off and cure the "yellows" and other diseases peculiar to the peach. Bridgeton, N. J. n. d. [n. c.] 86 pp. 7 x 5.

WILD, HENRY. The Making of a Country Estate; practical suggestions and professional advice for planning and planting of the gardens and development of the landscape features for country homes and estates. Illus. New York. [c. 1913.] American Bank Note Company. 31 pp. 11¼ in.

WILDER, GERRIT PARMILE. Fruits of the Hawaiian Islands. (Revised edition, including Vol. 1, 1906.) Illustrated by 121 half-tone plates with descriptions of same. Honolulu, T. H. 1911. [c. 1906, 1911.] Published by the Hawaiian Gazette Company, Ltd. 247 pp. 7 x 10½.

WILDER, MARSHALL PINCKNEY. The Horticulture of Boston and Vicinity. Substantially the same as the chapter prepared for the Boston Memorial Series, Vol. IV. Boston. 1881. Privately printed. Tolman & White, Printers. 85 pp. 9 x 6.

WILKINSON, ALBERT E. Modern Strawberry Growing. Illus. Garden City, N. Y. 1913. [c. 1913.] Doubleday, Page & Co. 210 pp. 7½ x 5.

WILLARD, ELEANOR WITHEY. The Children's Garden. With illustrations from photographs by Fedora E. D. Brown. Grand Rapids, Mich. 1904. The Michigan Trust Company. 39 pp. 9¼ in.

WILLIAMS, DORA. Gardens and Their Meaning. Illus. Boston, New York. [c. 1911.] Ginn & Co. ix + 235 pp. 8½ in.

WILLIAMS, E. Address on Pruning and Training the Vine. An illustrated paper read before the American Horticultural Society, at New Orleans, January 16, 1885, and published in full in the transactions of the Society for 1885. Indianapolis. 1885. Carlon & Hollenbeck, Printers. 13 pp. 9 x 6.

WILLIAMS, HENRY T. Window Gardening. Devoted specially to the culture of flowers and ornamental plants, for indoor use and parlor decoration. Illus. New York. 1872. [c. 1871.] Henry T. Williams. 302 pp. 8½ x 6.

———. The same. 4th ed. 1873. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 6th ed. 1873. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 11th ed. 1875. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 12th ed. 1876. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 13th ed. 1877. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 14th ed. 1884. [c. 1871.] 302 pp. 8½ x 6.

WILSON, WILLIAM. Economy of the Kitchen Garden, etc. New York. 1828.

WINKLER, HERBERT G. Vegetable Forcing; Parts I, II, and III. Columbus, Ohio. 1896. [c. 1896.] The Winkler Book Concern. 157 pp. 7¾ x 5½.

WINTER, T. A Guide to Floriculture; containing instructions to the young florist, for the management of the most popular flowers of the day. Illustrated with colored plates. Cincinnati. 1847. [c. 1846.] Derby, Bradley & Co. iv + 226 pp. 6¾ x 4½.

WINTER GARDENING IN A BAY WINDOW. By an amateur. East Saginaw, Mich. 1879. L. S. Laing, Printer. 33 pp. 8½ in.

WITTER, GEORGETTA. See Erwin, A. T. The Bush Fruits.

WOOD, WILLIAM H. S. See Thomas, John J. The American Fruit Culturist. 1897.

WOODS, DAVID R. Successful Floriculture. Illus. New Brighton, Pa. 1881. Published by the author. 108 pp. 9 in.

WOODWARD, GEO. E. and F. W. Woodward's Graperies and Horticultural Buildings. Illus. New York. [c. 1865.] Geo. E. Woodward & Co.; Orange Judd Company. 139 pp.

———. The same. New York. 1865. G. E. & F. W. Woodward. 7¾ in.

WOODWARD, R. T. Woodward's Book on Horticulture. The raising of large and small fruits. The diseases of the same, and the making and care of lawns. Boston. n. d. [c. 1897.] 74 pp. 7¾ x 5½.

WOODWARD'S RECORD OF HORTICULTURE. See Fuller, Andrew S.

WOOLSON, G. A. Ferns and How to Grow Them. Illus. New York. 1905. [c. 1905.] Doubleday, Page & Co. 156 pp. 7½ x 5½.

WOOLVERTON, LINUS. The Canadian Apple Grower's Guide. Part I. A complete guide to the planting, culture, harvesting and marketing of apples. Part II. Apples of Canada carefully described and illustrated from specimens of the varieties grown in the Dominion. Part III. Varieties of apples recommended for planting in the various apple districts of the Dominion. Illus. Toronto. 1910. [c. 1910.] William Briggs. 264 pp. 9½ x 7.

WORTHINGTON, JAMES T. Manual of Fig Culture in the Northern and Middle States. Chillicothe, Ohio. 1869. [c. 1869.] Scioto Gazette Office. 10 pp. 7¾ x 5¼.

WORTHINGTON, WILLIAM. See Lowther, Granville.

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WRIGHT, MRS. MABEL OSGOOD. The Garden of a Commuter's Wife, recorded by the gardener; with eight illustrations in photogravure. New York. 1901. The Macmillan Company. ix + 354 pp. 8 in.

———. The Garden, You, and I, by Barbara (*pseud.*). Illus. New York. 1906. The Macmillan Company. xii + 397 pp. 8 in.

WRIGHT, WALTER P. The New Gardening; a guide to the most recent developments in the culture of flowers, fruits, and vegetables. Illus. New York. 1913. Doubleday, Page & Co. 400 pp. 8 in.

YATES, LUCY H. The Gardener and the Cook. Illus. New York. 1913. McBride, Nast & Co. 260 pp. 7½ x 5½.

YEAR BOOK, THE, of the Farm and Garden. A reliable guide to all important rural occupations, embracing concise directions for the improvement of the soil by draining, subsoil plowing, and trenching; implements of culture—their history, cost, and relative value; rural architecture, with directions for the embellishment of the mansion by ornamental gardening; laying out and cropping the esculent garden, fruit culture, with directions for planting; lists of fruits, seeds, plants; insects injurious to farm and garden; bee culture, and other valuable miscellaneous matters. With new and beautiful illustrations. Philadelphia. 1860. [c. 1860.] A. M. Spangler. 108 pp. 7¼ x 4.

YOUNG, ERMENTINE. Canning and Preserving Fruits and Vegetables, and preparing fruit pastes and syrups. New York. 1892. [c. 1892.] The Rural Publishing Company. 31 pp. 7½ x 5. (The Rural Library, Vo. I, No. 8, June.)

YOUNG MEN'S CHRISTIAN ASSOCIATION, PORTLAND, ORE. Apple Growing in the Pacific Northwest, a condensation of lectures, experiments and discussions conducted by the educational department of the Portland, Oregon, Young Men's Christian Association. Illus. Portland, Ore. 1911. The Portland, Oregon, Young Men's Christian Association. 215 pp. 9½ in.

ZVOLANEK, ART. C. Culture and History of Winter Flowering Sweet Peas. Illus. Bound Brook, N. J. n. d. Printed by A. T. De La Mare Printing and Publishing Company. Paper. 65 pp. 7½ x 5½.

Subject index to the foregoing lists.

To aid the consultant to find the books on special subjects in the preceding bibliography, the following classified list is appended. It is impossible so to classify the titles as to organize them into definite and distinct groups, but the index may nevertheless afford the reader some relief. Many of the books cover a great variety of subjects; these are mostly placed under "General gardening and horticulture." Many of the titles are of such a nature that they cannot be entered in the index, as here constituted. The index designates only the books wholly or chiefly devoted to the given subject, and does not refer to chapters or parts in the miscellaneous or general books.

Evergreens and hedges.—Butterfield; Harrison; Hoopes; Main; Powell, E. P.; Warder.

Flowers and flower-gardening.—Adams; Allen, J. F.; Arnold; Barnard; Bennett; Blanchan; Bourne; Breck; Bridgeman; Buist; Casey; Clark; Cobbett; Complete Florist; Crawford; Darlington; Darrow; Dearborn; Doyle; Eley; Elliott, W. R.; Ely; Flower Garden; Frothingham; Green, R.; Halliday; Halsham; Harrison; Hassard; Hatfield; Henderson; Hibbert; Hooper, L.; How to Grow Asters; How to Make a Flower Garden; Hunt; Jenkins, E. N.; Johnson, L.; Johnson, S. O.; Keeler; Kirby; Long; Long Bros.; Loudon; McGregor; Maeterlinck; Mathews; Morton; Newman, J. B.; Page; Peacock; Practical Florist; Rand, E. S.; Rexford; Rion, H.; Rion, M. C.; Ruston; Sayers; Saylor; Scott, W.; Shelton; Smiley; Smith, E. E.; Solly; Tabor; Tuberous Begonias; Turner, C. H.; Vick; Washburn & Co.; Weed, C. M.; Wellcome; Winter; Woods.

Bulbs, special books: Allen, C. L.; Dreer; Fuld; Henderson; Rand, E. S.; Rexford; Tabor.

Carnation, special books: Lamborn; Ward.

Chrysanthemum, special books: Barker; Herrington; Mathews; Morton; Powell, I. L.; Smith, E. D.

Lily, special books: Adams; Boardman; Childs.

Orchids, special books: Boardman; Burberry; Hansen; Miner; Rand, E. S.

Rose, special books: American Rose Culturist; Buist; Drennan; Ellwanger, H. B.; Good; Hatton; Hole; Holmes, E.; Jenkins, T. B.; Parkman; Parsons, S. B.; Prince, W. R.; Roses and How to Grow Them; Saylor; Shaw, H.; Thomas, G. C.; Wellcome.

Sweet pea, special books: Dick; Hutchins; Kerr; Sunset Seed and Plant Company; Zvolanek.

Violet, special books: Galloway; Saltford.

Fruits and fruit-growing.—Alwood; Aspinwall, J.; Bailey; Baker, C. R.; Barry; Bates; Bealby; Bell; Biggle; Brehaut; Bridgeman; Brinckle; Budd; Cellon; Chase; Cobbett; Cole; Collingwood; Complete Kitchen and Fruit Gardener; Coxe; Creighton; Culver; Downing, A. J.; Downing, C.; Dwyer; Dygert; Elliott, F. R.; Elliott, W. R.; Favor; Fletcher, S. W.; Forsyth; Galusha; Gilbert; Goff; Goodrich; Gray; Green, C. A.; Green, S. B.; Greening; Gregg; Gurney; Haines; **Hansen, N. E.**; Harcourt; Hedrick; Hendrick; Herrick; Hooper, **E. J.**; **Hovey**; Hurst; Jaques; Kenrick; Kiely; Kitchen and Fruit **Gardener**; Knowlton, D. H.; Lacy; Larsen; Lawson; Lelong; **Leopold**; Lindley; McNeil; Manning, R.; Maynard; Merchant; **Moore, S. W.**; Morris; Moulson; Narrigan; Pabor; Paddock; **Parker**; Phelps; Phillips; Poole; Powell, E. C.; Powell, E. P.; **Prince, W. R.**; Rivers; Rockwell; Sayers; Sears; Smith, J.; **Stark**; Stedman; Stringfellow; Strong; Teague; Thacher; **Thomas, J. J.**; Thornton; Turner, W.; Warder; Waring; Waugh; **Wickson**; Wilder, G. P.; Young.

Apples, special books: Bailey; Beach; Buell; **Burritt**; **Cline**; Fitz; Green, C. A.; Lawrence; Powell, G. T.; Todd; **Waugh**; **Whitten**; Woolverton; Young Men's Christian **Association.**

Date, special book: Popenoe.

Fig, special books: Eisen; Roeding; Van Velzer; **Worthington.**

Grape, special books: Adlum; Allen, J. F.; Andrae; **Bailey**; **Barclay**; Becker; Berneaud; Bright; Buchanan; **Busby**; **Bush**; Chapman; Chazotte; Chorlton; De Caradeuc; De **Courtenay**; Denniston; Du Breuil; Dufour; Eakin; Eisen; **Emerson, E. R.**; Engelmann; Fisher; Flagg; Fuller; Grant; Green, **C. A.**; Hamm; Haraszthy; Haskell; Hedrick; Heyne; Hoare; **Hofer**; **Hoops**; Husmann; Hyatt; Kecht; Keech; Knowlton, **J. M.**; **Longworth**; Loubat; McCollom; McMullen; McMurtrie; **Mead**; **Millard**; Mitzky; Mohr; Muench; Munson; My Vineyard **at Lakeview**; Nessler; Osborn; Persoz; Phelps; Phin; Preyer; **Prince, W. R.**; Rafinesque; Reemelin; Riehl; Rixford; **Rubens**; **Saunders**; Sayers; Spooner; Strong; Tomes; Treatise on **Cultivation** of Grapes; Tryon; Van Buren; Viala; Wait; Warder; **Williams, E.**; Woodward, G. E.

Nuts, special books: Allen, W. F.; Dygert; Fuller; **Hume**; **Lelong**; Parry, J. R.; Price, E. M.; Risien; Roper; Stewart, **H. L.**; **Wight.**

Olive, special books: Bleasdale; Calkins; Chazotte; **Cooper**; **Flamant**; King; Lelong; Marvin; Pohndorff.

Oranges, lemons, and other citrous fruits, special books: **Canada**; Davis, G. W.; Fish; Fowler, J. H.; Gallesio; **Garcelon**; Garey; Hume; Lelong; Manville; Moore, T. W.; **Prange**; Spalding.

Peach, special books: Black; Fitz; Fletcher, R. R.; **Fulton**; **Harker**; Reinert; Rutter; Waugh; Wilcox.

Pear, special books: Berckmans; Black; Field, T. W.; **Green, C. A.**; Illustrated Pear Culturist; A New Treatise . . . . the pear tree; Parry, W.; Quinn; Thompson, W. W.

Plum and **prune,** special books: Clarke; Cope; Hedrick; **Lelong**; Waugh.

Quince, special book: Meech.

Small-fruits, special books: Abbott; Aspinwall, B.; **Barnard**; Bassett; Beede; Biggle; Blacknall; Boulton; Card; Cary; Clemmens; Crawford; Durand; Eastwood; Erwin; Farmer; **Fragaria**; Fuller; Galusha; Gillet; Green, C. A.; Grosvenor; **Hall**, D. M.; Hills; How to Grow Strawberries and other **Fruits**; Knapp; The Lawton or New Rochelle Blackberry; **M'Kay**; Merrick; Pardee; Parry, W.; Preyer; Purdy; Richards; **Roe**; Smith, M. O.; Snider; Starr; Strawberry Report; Terry; **Trowbridge**; Webb; White, J. J.; Whitten; Wilkinson.

General gardening and horticulture.—Adams; Agricola; Albaugh; Albee; Angier; Bailey; Baker, T.; Barnard; Barnes; **Batson**; Beadle; Beecher; Biggle; Bray; Bridgeman; Brooks; **Brown**, W. F.; Budd; Busch; Buschbauer; Church; Cleves; **Clute**; Cobbett; Collingwood; Copeland; Crosier; Davis, L. D.; **Duncan**; Earle; Edgeworth; Egan; Elder; Elliott, F. R.; Elliott, J. W.; Elwanger, G. H.; Ely; Fessenden; Field, F. E.; Field, H.; Fiske; Flint, E. D.; Flint, L. C.; Fullerton; The Garden; Gardiner; Gipson; Goff; Grundy; Hall, B.; Hall, G. P.; Hargrave; Harris; Harrison; Hawthorne; Hays; Hayward; Heikes; Hemenway; Henderson; Higgins; How to Grow Flowers, Fruit and Vegetables; Howard; Howe; Huber; Hunn; Jack; Jacques; Johnson, C.; Johnson, G. W.; Johnson, M. W.; Johnson & Stokes; Kains; Kirkegaard; Landreth; Laroque; Lelievre; Lindley, J.; Livingston, L. S.; Long; Lounsberry; Lowell; Lyon; MacGerald; McCauley; McLaren; M'Mahon; Marshall; Miller, C. H.; Miller, L. K.; Miller, T. B.; Miller, W.; Munro; Neill; Newman, J. S.; Oliver; Paine; Parsons, H. G.; Peck; Pierce; Powell, G. T.; Practical American Gardener; Prince, W.; Rand, A. C.; Rexford; Rion, H.; Rockwell; Roe; Rogers, J. E.; Rowles; Schenck; Scott, T.; Sedgwick; Seldon; Sewell; Seymour; Shafer; Shaw, E. E.; Shaylor; Sheehan; Shields; Shinn; Simson; Sinclair; Skinner, C.; Skinner, H.; Slade; Squibb; Stebbins; Stewart; Stewart, H.; Stewart, J. T.; Storke; Stringfellow; Tabor; Teat; Ten Acres Enough; Thaxter; Thomas, Mrs. T.; Thorburn; Tritschler; Underwood, L.; Urban; Utter; Verplanck; Warner, A.; Warner, C. D.; Watson; Weed, C. M.; White, W. N.; Whitner; Wilder, M. P.; Willard; Williams, D.; Woodward, R. T.; Woolson; Wright, M. O.; Wright, W. P.; Yates; Year Book of Farm and Garden.

Greenhouses.—Bryant; Dean; Field, F. E.; Fowler, A. B.; Hatfield; Herendeen; Leuchars; Rexford; Taft.

Landscape Gardening.—Agar; Allen, L. F.; Barron; Brown, G.; Cleaveland; Cleveland; Cunningham; Doogue; Downing, A. J.; Elliott, F. R.; Ferree; Follen; Greening; Hemenway; Hooper, C. E.; Humphreys; Johnson, J. F.; Kellaway; Kemp; Kern, G. M.; Kern, M. G.; Leland; LeMoyne; Long; Manning, W. H.; Maynard; Meier; Meyer; Miller, C. H.; Murmann; Oakey; Parsons, S.; Platt; Powell, E. P.; Repton; Rogers, W. S.; Root; Rose; Sawyer; Scott, F. J.; Skinner, H.; Smith, C.; Tabor; Underwood, Loring; Van Rensselaer; Vaux; Waugh; Weidenmann; Wharton; Wild.

Mushrooms.—Falconer; Gardiner; Hard; Jackson; Jacob; Milliken; Mushrooms for All; Palmer; Peck.

Plant-breeding.—Bailey; DeVries; Harwood.

Propagation.—Bailey; Fuller; Howard; Jenkins, J.; Lelong.

Pruning, grafting, and spraying.—Bailey; Couts; Des Cars; Dollins; Larsen; Lodeman; Northrop; Sargent; Stedman; Weed, C. M.; Weed, H. E.; Whitten.

Trees.—Davey; Des Cars; Dollins; Egleston; Fernow; Meehan; Peets; Powell, E. C.; Roe; Solotaroff.

Vegetables and vegetable-gardening.—Allen, C. L.; Bailey; Bateman; Bennett, Ida; Bridgeman; Buist; Burpee; Burr; Complete Kitchen and Fruit Gardener; Cook; Corbett; Darlington; Davis, J. R.; Dreer; Every Man His Own Gardener; Fessenden; Fitch; French; Fullerton; Green, S. B.; Gregory; Greiner; Halsted; Hogg; Holmes, F.; Kennerly; Kiely; Kitchen and Fruit Gardener; Kruhm; Landreth; Lloyd; McNeil; Morse; Oemler; Provancher; Quinn; Rawson, N.; Rawson, W. W.; Rockwell; Rolfs.; Sevey; Skinner, H.; Stringfellow; Thompson, F. S.; Tillinghast; Turner, W.; Vick; Waldin; Warner, A.; Washburn & Co.; Watts; Wickson; Wilson; Winkler; Young.

Asparagus, special books: Herrmann; Hexamer.

Cabbage, special books: Allen, C. L.; Cook; Gregory; Landreth; Lupton; Pedersen; Tillinghast's Plant Manual.

Cauliflower, special books: Allen, C. L.; Brill; Crozier; Gregory; Lupton; Pedersen; Suffa.

Celery, special books: Beattie; Crider; Greiner; Hollister; Landreth; Livingston; Niven; Pratt; Rawson, W. W.; Roessle; Schuur; Stewart, H. L.; Tillinghast's Plant Manual; Van Bochove; Vaughan's Celery Manual.

Cucumber, special book: Collins.

Melons, special books: Blinn; Burpee; Troop.

Onion, special books: Gregory; Greiner; Landreth; Onion Book; Onions; Underwood, J. P.

Potato, special books: Best; Bosson; Carman; Cultivation of the Potato; Fitz; Fraser; Grubb; McLaurin; Matchette; Price, R. H.; Rogers, E. A.; Tenbrook; Terry; Van Ornam.

Squash, special book: Gregory.

Tomato, special books: Day; Livingston; Mitchell; Smith, F. F.; Taylor, H.; Tracy; Van Camp.

Water-gardening.—Bissett; Conard; Tricker.

Window-gardening.—Allen, Phoebe; Barnes; Casey; Dorner; Heinrich; Hillhouse; Holmes, J. H.; Mulertt; Rand, E. S.; Randolph; Rexford; Rockwell; Rose; Waugh; Williams, H. T.; Winter Gardening in a Bay Window.

Reports of horticultural societies and organizations.

Although the present discussion aims only to supply librarians and collectors with information as to what reports and series have been published, a brief sketch of the beginnings of horticultural societies in North America may supply a useful background or setting.

Although the year 1785 witnessed the establishment of the Philadelphia Society for Promoting Agriculture and the Agricultural Society of South Carolina, 1889 the Nova Scotia Society, and 1792 the organization of the Massachusetts Society for Promoting Agriculture, it was apparently not until 1818 that the first horticultural organization came into existence; this was the New York Horticultural Society, now extinct. The second, organized in 1827, was the Pennsylvania Horticultural Society, which is still in vigorous existence. The third, according to Manning, was the Domestic Horticultural Society, organized at Geneva, New York, in 1828, and which was the forerunner of the Western New York Horticultural Society, the latter having continued for more than fifty years. The next organization was apparently the Albany Horticultural Society, established in 1829, but which expired long ago. In 1829, also, the Massachusetts Horticultural Society was organized, an association which, in the character of the men who have been members and in the large service it has rendered to the advancement of rural taste, stands without a rival in the country. The American Pomological Society was organized in 1850 by a union of the North American Pomological Convention and the American Congress of Fruit-Growers, both of which were established in 1848. The Congress of Fruit-Growers was a meeting held in New York on the 10th of October, 1848, at the call of the Massachusetts, Philadelphia, New Jersey and New Haven Horticultural Societies and the Board of Agriculture of the American Institute of the City of New York. The Pomological Convention held its first meeting on the 1st of September in Buffalo. The American Pomological Society is undoubtedly the strongest organization of pomologists in the world. A. J. Downing wrote in 1852, that "within the last ten years the taste for horticultural pursuits has astonishingly increased in the United States. There are, at the present moment, at least twelve societies in different parts of the Union devoted to the improvement of gardening, and to the dissemination of information on the subject." At the present time there are over 500 such societies, and the average attendance at the meetings cannot be less, in the aggregate, than 20,000. From a careful estimate made in 1891, it was concluded that the aggregate attendance for that year at the national, state, provincial and district societies "probably exceeded 5,000."

There are now more than a dozen national societies devoted to horticulture or some branch of it. The most gratifying feature of this movement toward organization, however, is the establishment of great numbers of local societies, florists' clubs, and the like, which sustain the interest in horticultural pursuits and foster pride in the personal surroundings of the members. All this great body of societies is proof enough that there is a rapidly expanding and abiding love of horticulture in America, and that it must increase with the increasing amelioration of the country.

There are few state or provincial departments of horticulture, but most of the states and provinces have bureaus of agriculture and these may publish horticultural matter. In this discussion, however, only those official establishments that are specially organized for horticultural work are included.

REPORTS OF BOARDS AND SOCIETIES.

In the following paragraphs an effort is made to give such information as a librarian needs in the collecting of the published annual reports of existing national, state, provincial and regional horticultural societies in the United States and Canada, and of the reports of state and provincial boards, commissions, or departments of horticulture. The publications of these various bodies follow so many methods and there is often such lack of continuity in them that it is difficult to follow them as a whole and, particularly, to know when sets and series are complete. As an aid in determining some of these points, corollary information of the societies and boards is given: these pieces of information are intended only as secondary aids to the librarian and not as descriptions or histories of the organizations.

AMERICAN ASSOCIATION OF NURSERYMEN. An annual report is published by the society. The first report was published in 1890 under the title, "Proceedings of the American Association of Nurserymen." The publication is continuous under the same title. Total number of volumes, 24. There have been no special reports. Organized 1876. Address, 204 Granite Building, Rochester, N. Y.

AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS. This association has published six reports for the years 1908–13 inclusive. It has also issued eleven bulletins on special subjects relating to roads, walks, planting of parks, and the like. Address, United States Department of Agriculture, Washington, D. C.

AMERICAN CARNATION SOCIETY. Annual reports are issued by the society. The first report was published in 1891 under the title, "Annual Report of the American Carnation Society." The publication still continues under this title. Total number of volumes, 23. There have been no special reports. Address, Indianapolis, Ind.

AMERICAN CRANBERRY GROWERS' ASSOCIATION. A semi-annual report is issued by the society. The first report was published in 1879 under the title, "New Jersey Cranberry Growers' Association." The publication has been continuous with one exception. Report of January meeting is entitled, "Proceedings of the Annual Meeting;" report of August meeting, "Proceedings of Annual Convention." Total number of volumes, 70. Address, Hammonton, N. J.

AMERICAN GENETIC ASSOCIATION, formerly called the American Breeders' Association. Annual reports were published for the years 1905–12, under the title, "Annual Report of the American Breeders' Association." Total number of volumes 8. From 1910–13, the "American Breeders' Magazine" was published quarterly. Beginning January, 1914, its name was changed to the "Journal of Heredity," which is published monthly, and the reports of meetings are published herein. Address, Washington, D. C.

AMERICAN GLADIOLUS SOCIETY. This society issues a bulletin from time to time. The first annual report was published in Bulletin No. 1, August, 1910; the second in Bulletin No. 7. The publication is still continued in the "Modern Gladiolus Grower." Address 538 Cedar St., Syracuse, N. Y.

AMERICAN PEONY SOCIETY. This society issues no regular publications. The Nomenclature Committee of the society, in coöperation with a representative of the New York State College of Agriculture, has prepared four bulletins which have been published by Cornell University. The first appeared in 1907 under the title "A Peony Checklist;" the second in 1908, as Bulletin No. 259, "The Peony;" the third in 1910, as Bulletin No. 278, "The Classification of the Peony;" the fourth in 1911, as Bulletin No. 306, "The Classification of the Peony." The society holds an annual meeting and exhibition in June. Address, Clinton, N. Y.

AMERICAN POMOLOGICAL SOCIETY. Biennial reports are published by the society. The first report (for 1850) was published in 1851 under the title, "Report of the American Pomological Congress," and was published by the Ohio State Board of Agriculture. The next report was issued in 1852 under the title, "Proceedings of the Second Session of the American Pomological Congress." The publication has been continuous under the title "Proceedings of the American Pomological Society," with the exception of the years 1866 and 1893, when no reports were published. Total number of volumes, 29. There has been one special report entitled, "The Cherry, together with reports and papers on pear, plum, peach, grape, and small fruit." A "Catalogue of Fruits" has also been published by this society. Organized in 1850 by the union of two other societies, both organised in 1848. Address, 2033 Park Road, Washington, D. C.

AMERICAN ROSE SOCIETY. This society issues an annual bulletin under the title, "Annual Proceedings and Bulletin," the first bulletin being issued in 1905. From April, 1912, until the middle of the year 1913, it also issued a quarterly journal entitled, "The Rose Journal." Organized 1899. Address, Beacon, N. Y.

AMERICAN SOCIETY OF LANDSCAPE ARCHITECTS. Has published one report of the transactions for the years 1899–1908 inclusive. The official organ of the society is a quarterly journal entitled "Landscape Architecture." Address, 15 East 40th St., New York City.

AMERICAN SWEET PEA SOCIETY. This society was originally organized in New York, July 7 and 8, 1909, as the "National Sweet Pea Society of America." Annual exhibitions and conventions are held every summer. Extensive trials of sweet peas are carried on under the auspices of the horticultural department of Cornell University, Ithaca, N. Y. Bulletins are issued by Cornell University, which go to the members of this Society. Address, New York City.

CANADIAN SEED GROWERS' ASSOCIATION. Annual reports are issued by the Association. The first report was published in 1904, under the title "Report of First Annual Meeting of the Canadian Seed Growers' Association." The publication still continues under this title. Special bulletins are issued from time to time, the last one being "Plant Breeding in Scandinavia." Address, Ottawa.

CHRYSANTHEMUM SOCIETY OF AMERICA. Annual meetings and exhibitions are held in November of each year of which an annual report is published together with the work of the committees. The first annual report was published in 1902. Address, Morgan Park, Ill.

INTERNATIONAL APPLE SHIPPERS' ASSOCIATION. This society issues an annual year-book, and a monthly bulletin. The first report was published in 1896 under the title, "International Apple Shippers' Association Year Book." Reports for 1900–1902 have the title, "Year Book of the National Apple Shippers' Association;" those for 1903–1909, "Year Book of the International Apple Shippers' Association;" those for 1910–14, "Official minutes of the International Apple Shippers' Association." A monthly bulletin began February, 1911, under the title, "The Spy." Both are continuous. There are special monthly reports issued for members only. Address, 612 Mercantile Bldg., Rochester, N. Y.

NATIONAL ASSOCIATION OF GARDENERS. Official organ is the "Gardeners' Chronicle of America," which contains all the association news. Address, Madison, N. J.

NATIONAL COUNCIL OF HORTICULTURE. Has issued no regular report except in 1907 of the Jamestown Congress of Horticulture. Copies of short articles on horticultural topics are sent to several thousand newspapers each spring.

NATIONAL NUT GROWERS' ASSOCIATION. This association issues an annual volume of proceedings and also a journal, "The Nut Grower," which is the official organ of the society, and consists of 24 pages monthly. It began publication in August, 1902. The first report was published in 1903 under the title, "Proceedings of the Second Annual Convention." There have been seven issues under the title "Proceedings of the Annual Conventions." There have been no special reports. Address, Cairo, Ga. Northern Nut Growers' Association. See *Nuts*, Vol. IV.

RAILWAY GARDENING ASSOCIATION. Reports of the annual meetings are published. The seventh report was issued in 1913. Address, Sewickley, Pa.

SOCIETY OF AMERICAN FLORISTS AND ORNAMENTAL HORTICULTURISTS. An annual report is published by the society. The first report was published in 1885 as "Proceedings of the Society of American Florists." After 1901, the title was changed to "Proceedings of Society of American Florists and Ornamental Horticulturists." Have also published a list of plants registered from July, 12, 1908 to August 1, 1914. National charter given March 3, 1901. Address 53 West 28th St., New York City.

SOCIETY FOR HORTICULTURAL SCIENCE. This society issues an annual report entitled, "Proceedings of the Society for Horticultural Science." The first report was published in 1905 under the title, "Proceedings of the Society for Horticultural Science. Preliminary meeting, September, 1903; first annual meeting, December, 1903; second annual meeting, 1904." Proceedings have been published annually since with the exception of the year 1908, which was published with 1909. Total number of volumes, 9. Address, College Park, Md.

VEGETABLE GROWERS' ASSOCIATION OF AMERICA. The first report was published in 1909 under the title, "Year Book of the Greenhouse Vegetable Growers' and Market Gardeners' Association of America." The next report contained the proceedings of the conventions of 1909, 1910 and 1911 and appeared under the title, "Official Proceedings of the Vegetable Growers' Association of America." The proceedings of the 1912 convention will probably be published with those of 1913 and 1914. Address, Louisville, Ky.

ALABAMA

ALABAMA STATE BOARD OF HORTICULTURE. The first report was published in 1903–4 under the title, "First Annual Report of the Alabama State Board of Horticulture." Only the first two reports have been published and these by the state. They have been published under one cover and also separately. Those from 1905–6 to 1911–12 are typewritten reports submitted to the Governor. There have been no volumes or reports on special subjects. This board is chiefly concerned with nursery inspection and the enforcement of the horticultural law approved March 5, 1903. The board consists of the Commissioner of Agriculture, president of the State Horticultural Society, director of the experiment station (ex-off.). The horticulturist of the experiment station is secretary of the board and State Horticulturist. Address, Auburn.

ALABAMA STATE HORTICULTURAL SOCIETY. This society issues annual reports which are published by both the state and the society. The first report was published in 1904 under the title, "Proceedings of the Alabama State Horticultural Society, First Annual Meeting." The publication is still continued under the title, "Proceedings of the Alabama State Horticultural Society." The first, second, third, and fourth annual reports were published by the society; the fifth, sixth and seventh were published in one volume by the Department of Agriculture, Montgomery, as serial No. 36, and the eighth annual report as a Department bulletin, serial No. 42. The ninth, tenth and eleventh annual reports have recently been issued by the society. Total number of volumes, 11. There have been no separate reports on special subjects. Organized January 27, 1903. Address, Auburn.

ARIZONA

ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE. This commission issues annual reports and circulars, published by the state. The first report was published in August, 1909, under the title, "First Annual Report of the Arizona Horticultural Commission." Four reports have been published under the title, "Annual Report of the Arizona Horticultural Commission." In 1912, the name of the organisation was changed as above and two reports have been published under the title "Annual Report Arizona Commission Agriculture and Horticulture." The annual reports of the State Entomologist are included in the reports of the commission. Sixteen circulars have been published on various entomological subjects. Address, Phoenix.

ARKANSAS

ARKANSAS STATE HORTICULTURAL SOCIETY. Annual reports are published by the society. The first report was published in 1900 under the title, "Annual Report of the Arkansas State Horticultural Society." The publication has been continuous under this title. Total number of volumes, 13, but this does not include two reports which were issued in 1894, (First and Second Annual Reports, 1893–4). At that time, a new society had been organized under the same name as the old horticultural society founded in 1879. The second society was finally merged into the first. Address, Horticultural Department, University of Arkansas, Fayetteville.

BRITISH COLUMBIA

BRITISH COLUMBIA FRUIT GROWERS' ASSOCIATION. An annual report is published by the province. The first report was published in 1890 under the title, "First Annual Report of the British Columbia Fruit Growers' Association." The reports from 1892–1895 have the title, "Annual report of the Horticultural Society and Fruit Growers' Association of British Columbia;" those from May, 1895, to August, 1897, "Report of the British Columbia Fruit Growers' and Horticultural Society;" those from 1908–9, "Annual and Quarterly Meetings of the British Columbia Fruit Growers' Association." The twenty-fourth annual report was issued in 1913. There have been no special reports, except a "Pest and Remedy" supplement, 1895–6, issued separately. Address, Victoria.

CALIFORNIA

CALIFORNIA ASSOCIATION OF NURSERYMEN. This organisation has published four reports, the first entitled, "Transactions and Proceedings of the First Annual Meeting of the California Association of Nurserymen, held . . . 1911." Address, Los Angeles.

CALIFORNIA STATE BOARD OF HORTICULTURE. The reports of this board have been published in six series. The first series consisted of one annual report published in 1883; the second of unnumbered biennial reports; the third of unnumbered annual reports; the fourth of numbered biennial reports beginning with No. 4; the fifth of numbered biennial reports beginning with No. 1. A series of bulletins have been published from 1883-1900 numbered from 1-71. It is doubtful, however, whether any were issued between 8 and 50. Five non-serial reports were issued between 1886 and 1901 consisting of reports of committees, library catalogues and the like. Separate reports have also been issued of the proceedings of the Fruit Growers' Convention. The first report issued by this board was published in 1883 under the title, "Third Annual Convention of the Fruit Growers of the State of California." Reports of succeeding conventions have been published, either in separate form or in the report of the State Board (later in the report of the State Commission), with the exception of the twentieth to twenty-third conventions which were never published. At least three state conventions of olive-growers have been held under the auspices of the State Board of Horticulture, 1891-3, for which separate reports have been issued. These have appeared under the title "Olive Industry. Proceedings of the State Convention of Olive Growers, held under the auspices of the State Board of Horticulture." Organized March 4, 1881, as a subsidiary board to the State Board of Viticultural Commissioners. On March 13, 1883, became independent by Act of Legislature.

CALIFORNIA STATE BOARD OF HORTICULTURAL COMMISSIONERS. This board published a report in 1882 entitled, "First Report of the Board of State Horticultural Commissioners," covering the work from 1880-2; also proceedings of first and second Fruit Growers Convention.

CALIFORNIA STATE BOARD OF VITICULTURAL COMMISSIONERS. Published seven annual reports for the years 1880-94. Of the first report, 1880, two editions were issued. The third report, 1882-4, was published in, or rather was identical with, the report of the chief viticultural officer for those years. There were also issued separately two annual reports of the chief viticultural officer, the first for 1881, published 1882, the second for 1882-3 to 1883-4 (being the one just mentioned). Later reports of the viticultural officer are contained in the annual reports of the board. Two publications, "Grafting to Muscats" and "Wines, Their Care and Treatment," issued in 1888 and 1889, are called Appendix 4 and 5 respectively of the report for 1888, but no report for 1888 seems to have appeared. However, there was issued a report of proceedings of sixth annual viticultural convention and the report of the president of this board. These may have constituted the report for this year.

CALIFORNIA STATE COMMISSION OF HORTICULTURE. This organisation has grown out of the original State Board of Horticulture. It publishes a biennial report. The first report, 1903-4, was issued under the title, "First Biennial Report of the Commissioner of Horticulture." Total number of volumes, 6. Reports of the forty-third and forty-fourth State Fruit Growers' Conventions were not published. Monthly bulletins have been published since December 1911. Address, Capitol Building, Sacramento.

COLORADO

COLORADO STATE BOARD OF HORTICULTURE. The first report was issued in 1884. Reports have been published continuously since then, with the exception of the year, 1895-6, which was never published. There has been considerable variation in the title, and the reports have been sometimes annual, sometimes biennial, the first covering three years. Up to 1886, the name of the body was Colorado State Horticultural Society; 1887-90, Colorado State Horticultural and Forestry Association; 1891-2, Colorado State Bureau of Horticulture; 1893 to 1913, Colorado State Board of Horticulture. In 1913, the State Board of Horticulture was abolished, and the office of State Horticulturist created. The report of the State Horticulturist will take the place of the Annual Report of the Board of Horticulture. Total number of volumes, 24. Address, Fort Collins.

CONNECTICUT

STATE POMOLOGICAL SOCIETY. This society has published an annual report for the past 15 years. The first report was issued under the title "A brief record of the work of the Connecticut Pomological Society," in 1900. Total number of volumes, 16 Organized in 1891. Address, Milford.

DELAWARE

PENINSULA HORTICULTURAL SOCIETY. An annual report is published by the society. The first report was published in 1888 under the title, "Transactions of the Peninsula Horticultural Society." The publication is still continued under this title. Total number of volumes, 27. Volume XIV was issued in two parts, Part I, the Proceedings of the annual session of 1901 and Part II, a pamphlet of 80 pages on "The Principal Pests and Diseases of the Apple Orchard." Address, Dover. (This society includes also a part of Maryland and Virginia.)

FLORIDA

FLORIDA STATE HORTICULTURAL SOCIETY. An annual report is published by the society. The first report was published in 1892 under the title, "Transactions of Florida State Horticultural Society." This title was continued up to 1909 when it changed to "Proceedings of the Florida State Horticultural Society." The publication has been continuous. Total number of volumes, 22. Special papers on flowers, fruits, vegetables and the like appear in the reports but are not published separately. Organised in 1887. Address, Jacksonville.

GEORGIA

GEORGIA STATE HORTICULTURAL SOCIETY. Annual reports are issued, now published by the society. The first report was published in 1877 under the title, "Proceedings of Georgia State Horticultural Society." The publication is still continued. The first to thirtieth reports were published by the society. The next five were published by the State Board of Entomology,—Bulletins Nos. 25, 27, 30, 33, 35. The report for 1912 was published by the State College of Agriculture as a part of the report of the Fourth Annual Farmers' Conference held in 1912. The thirty-eighth report, for 1914, was published as a bulletin of the State College of Agriculture, Vol. 2, No. 12. This report was afterward published separately by the society. Total number of volumes, 38. There have been no special reports. Address, College of Agriculture, Athens.

NORTH GEORGIA FRUIT GROWERS' ASSOCIATION. The society has issued two reports, the first entitled, "Proceedings of the Sixth Annual Session of the North Georgia Fruit Growers' Association . . . 1902." A report of the seventh session for 1904 is also published.

HAWAIIAN ISLANDS

There is no separate horticultural organization, only the Board of Commissioners of Agriculture and Forestry.

IDAHO

IDAHO STATE HORTICULTURAL ASSOCIATION. An annual report is published by the society. The first report was published in 1904 under the title, "Annual Report of the Idaho State Horticultural Association." The publication has been continuous under this title. Total number of volumes, 9. There have been no special reports. Address, Boise.

ILLINOIS

ILLINOIS STATE HORTICULTURAL SOCIETY. Annual reports are published by the society. The first report was published in 1856 under the title, "Transactions of the Illinois Horticultural Society." The publication is still issued under this title. The report of the first annual meeting was published in Volume II of the Illinois Agricultural Society Transactions. There was no report of the second annual meeting. The third meeting was published in Volume III, Illinois Agricultural Society Transactions, the fourth in the Prairie Farmer, the fifth in Volume IV, Agricultural Society Transactions, sixth, seventh (these two bound in one volume), and eighth in pamphlet form, ninth in Volume V, Agricultural Society Transactions, tenth in pamphlet form and the eleventh in a bound volume. The proceedings of the twelfth annual meeting were issued as Volume I New Series. There have been 47 issues in this series to date. Total number of volumes is as follows: Four reports bound in the Transactions of the Illinois Agricultural Society, 1 in the Prairie Farmer, 4 pamphlets and 46 bound volumes. The only special report ever published was of the Society's Exhibit at the World's Fair in 1893. Beginning with March, 1913, has issued a quarterly journal entitled "Illinois Horticulture." Address, Normal.

HORTICULTURAL SOCIETY OF CENTRAL ILLINOIS. This society issues annual reports that are published in the Transactions of the State Horticultural Society.

HORTICULTURAL SOCIETY OF NORTHERN ILLINOIS. The annual report of this society is published in the transactions of the state society. The transactions of the first and fourth meeting, 1867-8, 1871, were also published in separate form. The first has the title, "Transactions of the Northern Illinois Horticultural Society embracing the first organization and meeting . . . December 18, 1867. With the proceedings and essays at the first annual meeting . . . February 13, 1868."

HORTICULTURAL SOCIETY OF SOUTHERN ILLINOIS. The annual report of this society is also published in the report of the state society.

INDIANA

INDIANA HORTICULTURAL SOCIETY. This society issues an annual report published by the state. The first report was published in 1866 under the title, "Transactions of the Indiana Horticultural Society." The publication has been continuous under the one title. Total number of volumes, 53. Bulletins on special subjects were published by the society from 1904-11. Organised 1860. Address, W. Lafayette.

IOWA

IOWA STATE HORTICULTURAL SOCIETY. Annual reports, published by the state, are issued by this society. The first report was issued in 1868 under the title, "The Proceedings of the Iowa State Horticultural Society, for 1866–7." From 1871–7, the reports have the title "Annual Report;" from 1878–90, "Transactions;" and from 1891 to the present time, "Report." Total number of volumes, 47. The reports from 1866–70 were bound with the agricultural report and also in paper separates; since that time, they have been bound as separate volumes. The society has issued seven bulletins: "Forestry Manual," 1881; "Plants of Iowa," 1907; "Iowa Horticulture," 1908; "Proceedings Iowa Park and Forestry Association," 1904, 1905, 1906, 1907." Address, Des Moines.

KANSAS

KANSAS STATE HORTICULTURAL SOCIETY. This society issues biennial reports published by the state. The first report was published in 1871 under the title, "Condensed Transactions of the Kansas State Pomological and Horticultural Society from its organization to its last annual meeting, and in full for the year 1871." From 1877–86, the reports were issued under the title, "Kansas Horticultural Report;" from 1887–95, "Biennial Report of the Kansas State Horticultural Society." The reports up to 1887 and for 1896–1901 were published annually. Total number of volumes, 32. Special reports have been published on forestry, apple, peach, plum, grape, cherry and apricot. Address, State House, Topeka.

KENTUCKY

KENTUCKY STATE HORTICULTURAL SOCIETY. A few publications have been issued by this society at long intervals, but no complete records of these are available. In 1865, a report was published under the title "Report of the Kentucky State Pomological Society;" in 1881, "Proceedings of the Kentucky Horticultural Society at its annual meeting, Jan. 13, 14 and 15, 1880." The Proceedings for 1907 were published in the Report of the Bureau of Agriculture, Labor and Statistics for 1907. The report for 1911 was issued as "The Report of the Kentucky State Horticultural Society" and was also published in the Report of the Bureau of Agriculture, Labor and Statistics for 1911. There was no report for 1912. The report for 1913 was also published in the Report of the Bureau of Agriculture. etc. The report for 1914 was issued as "The Report of the Kentucky State Horticultural Society." Address, College of Agriculture, Lexington.

LOUISIANA

LOUISIANA STATE HORTICULTURAL SOCIETY. This society issues no reports at present and held no meetings from 1908–1912. Previous to this time, however, annual reports were issued by the state. The first report was published about 1901 under the title, "State Horticultural Society Proceedings." From 1904–8, five volumes were issued as "Proceedings of the Annual Meeting." The last meeting of the old horticultural society was held in 1908 and in 1912 it was reorganized and holds annual meetings at the State University, Farmer's Short-course in January of each year. Address, Baton Rouge.

MAINE

MAINE STATE POMOLOGICAL SOCIETY. Annual reports are published by the society. The first report was published in 1873 under the title, "Annual Report of the Maine State Pomological Society." Reports have been published continuously except for the years 1879, 1880 and 1881. Abstracts from the Transactions of these years were published as an appendix to the Transactions for 1890. In 1882, the title was changed to "Transactions of the Maine State Pomological Society." In most cases, these reports have also been contained in the report of the Commissioner of Agriculture. Organized in 1873. Address, Bowdoinham.

MANITOBA

MANITOBA HORTICULTURAL AND FORESTRY ASSOCIATION. Annual reports are published by the association. The first report was issued in 1898 under the title, "Report of Proceedings of the Western Horticultural Society for the years 1896–8." The publication is still continued but in 1911, the name of the society was changed to "Manitoba Horticultural and Forestry Association." They were published as biennial reports from 1896–8 and 1901–2, as a triennial report for 1902–5 and as annual reports from 1898–1900 and 1906–9. No report for 1910. Annual report for 1911 and biennial report for 1912–13 and 1914 have been published. Total number of volumes, 12. A few short papers have also been published by the Association. In April 1914, a monthly publication known as the "Manitoba Horticulturist" was issued by the association. Future annual reports will consist of bound copies of the year's issue of this monthly, together with a short account of the annual meeting. Address, Agricultural College, Winnipeg.

MARYLAND

MARYLAND STATE HORTICULTURAL SOCIETY. An annual report is issued, published by the society. The first report was published in 1898 under the title, "Report of the Maryland State Horticultural Society." The publication is continuous under this title. Total number of volumes, 16. There have been no special reports. Address, College Park.

MASSACHUSETTS

MASSACHUSETTS ASPARAGUS GROWERS' ASSOCIATION. Formed in 1906 to promote the restoration of asparagus to its immunity from rust, or the discovery of a species that shall be rust-resistant, and the dissemination of information in relation to its growing and marketing. Is in close touch with the coöperative experiments carried out at Concord by the United States Department of Agriculture and the Agricultural Experiment Station at Amherst. The association holds an annual field-day in September and publishes a report of the proceedings. Bulletin No. 263, United States Department of Agriculture by J. B. Norton is devoted to these experiments. Address, Concord.

MASSACHUSETTS HORTICULTURAL SOCIETY. This society publishes its own annual report. The first report was issued in 1829 under the title, "Massachusetts Horticultural Society." One number, March, 1859, was published under the title, "The Journal of the Proceedings." The publications have been continuous since 1839. It was formerly published in one volume once a year, but since 1874 it has been published in two parts annually or occasionally in three, as in the case of 1895–7. There are numerous special articles in the Transactions on the culture of flowers, fruits and vegetables. The society has also issued the following publications: in 1862, "Properties of Plants and Flowers;" in 1864, "Proceedings on the occasion of the laying of the corner-stone of the new hall;" in 1873, a "Catalogue of the Library;" in 1880, "History of the Massachusetts Horticultural Society, 1829–78;" in 1889, "Window Gardening, and a list of some of the flowers found growing naturally in the vicinity of Boston." Address, Horticultural Hall, Boston.

MICHIGAN

MICHIGAN STATE HORTICULTURAL SOCIETY. This society issues an annual report published by the state, and also a monthly journal called "Michigan Horticulture." The first report was published in 1870 under the title, "Annual Report of the Michigan State Pomological Society." The publication has been continuous with the exception of the year 1904, when no report was published. The report for 1905 is in the back of the report for 1906. The title was changed in 1881 to "Annual Report of the State Horticultural Society." Total number of volumes, 42. Address, Fennville.

MINNESOTA

MINNESOTA STATE HORTICULTURAL SOCIETY. An annual report and a monthly magazine entitled, "Minnesota Horticulturist," are published by the state. The first report was published in 1873 under the title, "History of the Minnesota Horticultural Society from the first meeting in 1866, to the last in 1873, comprising debates, addresses, essays and reports." Reports for 1874–82 have the title, "Transactions." The Minnesota Horticulturist began publication in February, 1894, with Vol. 22, the volume number of the annual report for that year, and continues this system of numbering. The publication is still continued, but in 1899 the title was changed to "Trees, Fruits and Flowers of Minnesota." This comprises the 12 monthly journals and the annual report of the society, bound together. Total number of volumes, 43. There have been no special reports. Address, 207 Kasota Block, Minneapolis.

MISSISSIPPI

A State Horticultural Society existed about twenty-five years ago and published one or two reports.

MISSOURI

MISSOURI STATE BOARD OF HORTICULTURE. The Board issues an annual report published by the state. The first report was published in 1907 under the title, "Annual Report of the State Board of Horticulture." The publication has been continuous under the same title. The publications of the State Horticultural Society since 1907 have been included in the Reports of the State Board. Total number of volumes, 7, the last being chiefly taken up by orchard census of the state of Missouri taken in 1913. There have been 67 bulletins published on various phases of fruit-growing, vegetable-growing and the like, most of which are reprints of special articles from the reports. Two circulars and ten pamphlets have also been issued Address, Columbia.

MISSOURI STATE HORTICULTURAL SOCIETY. From 1857–1907, annual reports were issued. These comprise 50 volumes, published by the state. They were published under the title, "Reports of the State Horticultural Society." The report is now embodied in the Report of the State Board. In the past ten years, this society has issued a number of special bulletins. Address, Mountain Grove.

MONTANA

MONTANA STATE BOARD OF HORTICULTURE. Biennial reports are published by the state. The first report was published in 1900 under the title, "First Biennial Report of the State Board of Horticulture." The publication is still continued under the above title. Total number of volumes, 6. There have been no special reports. Address, Missoula. The 1914 report will be combined in the volume of the report of the Horticultural Society.

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MONTANA STATE HORTICULTURAL SOCIETY. This society issues annual reports published by the state. The first report was published in 1907 under the title, "Proceedings of the Ninth Annual Session of the Montana Horticultural Society." The publication has been continuous under the same title. In connection with the fifteenth report, is the first report of the Country Life Commission. In January, 1902, there was printed a series of papers in pamphlet form, including the constitution and by-laws of the society. Total number of volumes, 8. There have been no special reports. Address, Missoula.

NEBRASKA

NEBRASKA STATE HORTICULTURAL SOCIETY. An annual report is published by the society. The first report was published in 1870 under the title, "Annual Report of the State Horticultural Society," and was printed in the same volume as the report of the State Board of Agriculture. The publication is still published under this title. Thirty-two bulletins on particular phases of horticulture have been published. Since February, 1911, the society has published a monthly journal, "Nebraska Horticulture." Total number of reports, 45. Address, Capitol Building, Lincoln.

NEVADA

There are no horticultural societies in Nevada.

NEW BRUNSWICK

NEW BRUNSWICK FRUIT GROWERS' ASSOCIATION. This society issues annual reports published by the province. The first report was published in 1905 in the "Report on Agriculture for 1904," issued by the Department of Agriculture. The publication is continuous. Up to 1911, the reports were published in the annual report of the Department of Agriculture. The Report of the Horticultural Division, Department of Agriculture, was combined with the report of the association for 1910 and published as a separate document in that year. Total number of reports, 9. No special reports. Address, Fredericton.

HORTICULTURAL DIVISION, NEW BRUNSWICK DEPARTMENT OF AGRICULTURE. The first annual report was published in 1910 in the general report of the Department. In 1911, a separate report was published with the association report. The division publishes leaflets and bulletins on special subjects. Established in 1910. Address, Fredericton.

NEW HAMPSHIRE

NEW HAMPSHIRE HORTICULTURAL SOCIETY. Annual reports are published by the society. The first report was published in 1908 under the title "Annual Report of the New Hampshire Horticultural Society." The publication has been continuous under the same title, except for the year 1911. There have been no special reports. Organized in 1893. Address, Goffstown.

NEW JERSEY

NEW JERSEY STATE HORTICULTURAL SOCIETY. This society issues an annual report published by the state. The first report was published in 1876 under the title "Proceedings of the New Jersey State Horticultural Society at its Annual Meeting." The publication is continuous under the same title. Total number of volumes, 39. There have been no special reports. Organized in 1875. Address, Riverton.

NEW YORK

EASTERN NEW YORK HORTICULTURAL SOCIETY. This organization is now a part of the New York State Fruit Growers' Association.

HORTICULTURAL SOCIETY OF NEW YORK. A quarterly journal containing the reports of proceedings and the like is published by the society. Also memoirs devoted to special subjects are issued. Vol. I. "Report of Second International Plant Breeding Conference," 1902; Vol. II. "Report of International Conference on Acclimatization," 1900. Address, New York Botanical Garden. Society organized 1900; incorporated 1902.

NEW YORK STATE FRUIT GROWERS' ASSOCIATION. Annual reports and crop bulletins are issued, published by the society. The first report was published in 1903 under the title, "Proceedings of the Annual Meeting." The publication is still continued under this title. Total number of volumes, 13. There have been no special reports. Address, Penn Yan.

NEW YORK STATE VEGETABLE GROWERS' ASSOCIATION. Organized 1911; has published two volumes of proceedings. Address, Ithaca.

WESTERN NEW YORK HORTICULTURAL SOCIETY. The first annual report was issued in 1874 under the title, "Proceedings of Western New York Horticultural Society." The publication still continues under the same title. Total number of volumes, 40. There have been no special reports. Established 1855. Address, 204 Granite Building, Rochester.

NORTH CAROLINA

DIVISION OF HORTICULTURE OF THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE. The reports of the Division of Horticulture are included in the Department reports. Biennial reports have been published since 1900, making seven to date. Monthly bulletins have been issued since 1879 by the Department, only a few of which are strictly horticultural. There are 35 volumes in this series. Special horticultural circulars are also issued from time to time. Address, Raleigh.

NORTH CAROLINA STATE HORTICULTURAL SOCIETY. This society has not been in active existence for some years but it is now in process of reorganization. A few annual reports, however, have been issued, those for 1886, 1893, 1894, 1898 and 1906. There have been issued separately five reports of the Experimental Farm of the society at Southern Pines. They have also published the following special bulletins: "The Cow Pea," "Plant Food," and "Truck Farming."

NORTH DAKOTA

NORTH DAKOTA HORTICULTURAL SOCIETY. No reports published. Members receive those published by the Minnesota Horticultural Society.

NOVA SCOTIA

NOVA SCOTIA FRUIT GROWERS' ASSOCIATION. An annual report is published by the society. The first report was published in 1875 under the title, "Report of the Fruit Growers' Association and International Show Society of Nova Scotia." No other reports were published until 1883. Those from 1883–1894 bore the title, "Transactions and Reports of the Fruit Growers' Association and International Show Society of Nova Scotia;" those from 1895 to the present time, "Annual Report of the Fruit Growers' Association of Nova Scotia." The publication is continuous under the same title. Total number of volumes, 31. Address, Port Williams.

OHIO

COLUMBUS HORTICULTURAL SOCIETY. Annual reports published by the society are issued. From 1845–1886, the proceedings of the monthly meetings were published in Columbus newspapers. From 1886–1890, a journal was issued monthly and from 1890–1895, this journal was issued as a quarterly. These publications were entitled "Journals of the Columbus Horticultural Society." From 1890 to the present time, the society has published an annual report under the title, "Proceedings of the Columbus Horticultural Society." Total number of volumes, 27. Address, Columbus.

DIVISION OF HORTICULTURE OF THE OHIO DEPARTMENT OF AGRICULTURE. This organization has issued at least three bulletins, 1907–1909.

OHIO STATE HORTICULTURAL SOCIETY. This society was organized in 1847 as the "Ohio Pomological Society," whose first report was published in 1848. In 1866, the name of the society was changed to the "Ohio State Horticultural Society." This society issues an annual report. The first report was published in 1868 under the title "Annual Report of the Ohio State Horticultural Society (late Pomological Society)." Reports for 1907–8 are published in Bulletins Nos. 1 and 3 of the Division of Horticulture of the Ohio Department of Agriculture. Since 1908, the annual reports have been issued independently. Quarterly bulletins have been issued during the past three years. Total number of volumes, 47. Address, Newark.

OKLAHOMA

OKLAHOMA STATE FRUIT GROWERS' ASSOCIATION. Issues no publications.

ONTARIO

FRUIT BRANCH OF THE ONTARIO DEPARTMENT OF AGRICULTURE. Annual reports, published by the province, are issued. The first report was published in 1909 under the title, "Annual Report of the Fruit Branch of the Ontario Department of Agriculture." This publication is now incorporated in the annual report of the Minister of Agriculture. From 1894–1907, a separate report, "The Fruit Experiment Stations of Ontario," was published by the Department. This was merged with the Fruit Branch in 1908. Total number of volumes, 14. A special report on "Fruits of Ontario" was published in 1906 and revised in 1914. Special reports on fumigation and, orchard spraying were issued for a few years but are now combined with the Report of the Fruit Branch. Complete bulletins of every fruit grown in Ontario and also on special horticultural subjects are issued and revised from time to time as part of a regular series of bulletins published by the Ontario Department of Agriculture. Address, Parliament Buildings, Toronto.

FRUIT GROWERS' ASSOCIATION OF ONTARIO. This society issues an annual report published by the province. The first report was published in 1863 under the title, "Report of the Fruit Growers' Association of Upper Canada." The publication is continuous, but "Ontario" has been substituted for "Upper Canada." Total number of volumes, 49. Address, Parliament Buildings, Toronto.

HORTICULTURAL SOCIETIES OF ONTARIO. This organization publishes an annual report. The first report was published in 1907 under the title, "First Annual Report of the Horticultural Societies of Ontario." Total number of volumes, 8. Address, Parliament Building, Toronto.

ONTARIO VEGETABLE GROWERS' ASSOCIATION. This society was organized in 1909 and has held annual meetings since that time. Proceedings of all the meetings are published. Address, Parliament Buildings, Toronto.

OREGON

OREGON STATE BOARD OF HORTICULTURE. This board issues biennial reports published by the state. The first report was published in 1891 under the title, "Biennial report of State Board of Horticulture." The publication is continued under the above title. Total number of volumes, 12. There have been special bulletins issued on fruits, spraying, orchard management and the like. They have issued at least nine numbered bulletins of which 1–3 may be found in the first biennial report and 5–7 in the second. Address, Portland.

OREGON STATE HORTICULTURAL SOCIETY. An annual report is published by the state. The first report was published in 1909 under the title, "Proceedings and Papers of the Twenty-fifth Annual Meeting of the Oregon State Horticultural Society." In 1892, one report was published in connection with the Report of the State Board of Horticulture. The publication is continued under the title "Proceedings and Papers of the Annual Meeting of the Oregon State Horticultural Society." Total number of volumes, 5. There have been no special reports. Address, Portland.

PENNSYLVANIA

STATE HORTICULTURAL ASSOCIATION OF PENNSYLVANIA. Annual reports are published, usually by the society, but from 1878–1894 they were published in connection with the reports of the State Board of Agriculture of Pennsylvania. The report for 1895 was issued as Bulletin 8 of the State Board of Agriculture; those for 1896 and 1899–1906 were published in the annual report of the Department of Agriculture. The first report was published sometime between 1860 and 1867 under the title, "Report of Eastern Pennsylvania Fruit Growers' Society." Later, it was issued under the title, "Report of Pennsylvania Fruit Growers' Society." After 1881, it appeared under the title, "Report of State Horticultural Association of Pennsylvania." The publication has been continuous with the exception of the year 1897, which was never published. There have been no special reports. Organized in 1860. Address, Flora Dale.

PORTO RICO

PORTO RICO HORTICULTURAL SOCIETY. Only one report has been published, that of 1911–12, under the title, "First Annual Report of the Porto Rico Horticultural Society." From July, 1908, to October, 1910, the "Porto Rico Horticultural News" was issued monthly as the official organ of the Porto Rico Horticultural Society. In December, 1910, this journal was merged with "Porto Rico Progress" which has since been issued weekly. Address, Mayaguez.

PRINCE EDWARD ISLAND

FRUIT GROWERS' ASSOCIATION OF PRINCE EDWARD ISLAND. This society issues annual reports published by the Department of Agriculture. The first report was published in 1896 under the title, "First Annual Report of the Fruit Growers' Association of P. E. I." The publication is still continued under this title. Some of the reports are bound with the Report of the Department of Agriculture and are not published separately. Total number of volumes, 15. There have been no special reports. Address, Charlottetown.

QUEBEC

MONTREAL HORTICULTURAL SOCIETY AND FRUIT GROWERS' ASSOCIATION OF THE PROVINCE OF QUEBEC. This society published its first annual report in 1876 under the title, "First Report of the Fruit Committee of the Montreal Agricultural and Horticultural Society." The second report was entitled "Transactions and Second Report of the Fruit Committee, etc," and was published in 1877. From 1877–1882, the reports have the title "Report of Montreal Horticultural Society and Fruit Growers' Association of the Province of Quebec." Later reports have the same title with the words "Annual Report" substituted for "Report." The society has not been in active existence since about 1893 and no recent reports have been published.

POMOLOGICAL AND FRUIT GROWING SOCIETY OF THE PROVINCE OF QUEBEC. Annual reports and pamphlets are issued, published by the society but paid for by the Government. The first report was published in 1895 under the title, "Annual Report of the Pomological and Fruit Growing Society of the Province of Quebec." The publication is continuous under this title. Total number of volumes, 21. There have been no special reports. Chateauguay.

RHODE ISLAND

RHODE ISLAND HORTICULTURAL SOCIETY. This society issues no publications except premium lists for its exhibitions. Address, Providence.

SOUTH CAROLINA

HORTICULTURAL SOCIETY OF SOUTH CAROLINA. This society is not now in existence. It published only one report in 1889 entitled "Report of the First Meeting of the State Horticultural Society."

SOUTH CAROLINA FRUIT GROWERS' ASSOCIATION. This society was organized about six years ago but has held only one meeting. No publications have as yet been issued. Address, Greenville.

SOUTH DAKOTA

SOUTH DAKOTA STATE HORTICULTURAL SOCIETY. This society issues an annual report published by the state. The first report was published in 1904 under the title, "First Annual Report of the Thirteenth Meeting." The publication is continuous under the title, "Annual Report." Total number of volumes, 11. There have been no special reports. Incorporated under state law, January 9, 1890. Address, Brookings.

TENNESSEE

TENNESSEE STATE HORTICULTURAL SOCIETY. Annual proceedings are issued, beginning with 1914.

TENNESSEE STATE NURSERYMEN'S ASSOCIATION. Proceedings are issued annually, the first appearing in 1914. Address, Knoxville.

TEXAS

TEXAS NURSERYMEN'S ASSOCIATION. This association holds annual meetings, reports of which are published in the reports of the Texas Farmers' Congress. No special reports are issued. Address, Sherman.

TEXAS NUT GROWERS' ASSOCIATION. This association was organized in 1904 and continued until July, 1910, when it was merged into the State Horticultural Society. One bulletin on pecans was published with the proceedings of the Texas Farmers' Congress; "Pecans and Other Nuts in Texas," 1908. "The Pecan and Hickory in Texas," by E. J. Kyle was published by the Texas Department of Agriculture in bulletin form in 1911.

TEXAS STATE HORTICULTURAL SOCIETY. An annual report is published in the general proceedings of the Texas Farmers' Congress, published by the Department of Agriculture, bulletin form. In 1889, there was a report published by the society containing the reports of meetings from 1886–1889 under the title, "Initial Report of the Texas State Horticultural Society." No other reports were published until about 1905 when they were included in the Farmer's Congress Report. There are no special reports. Address, College Station.

UTAH

UTAH STATE HORTICULTURAL COMMISSION. This organisation publishes a biennial report. The first report was issued in 1897 under the title, "Report of the State Board of Horticulture." Reports from 1897–1908 have the title, "Biennial Reports of the State Board of Horticulture;" 1909–1910, "Biennial Report of the State Horticultural Commission." Total number of volumes, 9. There have also been at least 9 numbered bulletins, the first six numbers of which appear also in the annual reports. Address, 412 Vermont Building, Salt Lake City.

UTAH STATE HORTICULTURAL SOCIETY. An annual report is issued by the society. The first report was published in 1912 under the title, "Proceedings of the Sixth Annual Convention of the Utah State Horticultural Society." A report of the eighth annual convention, 1912, has been issued. Organized 1905. Address as above.

VERMONT

VERMONT STATE HORTICULTURAL SOCIETY. This society issues annual reports published by the state in "Vermont Agriculture" and also as separates. The first report was published in 1896 under the title, "Report of First Annual Meeting of Vermont State Horticultural Society." No other report was published until 1905, when there was issued the "Second Annual Report of the Vermont State Horticultural Society, Proceedings of the Tenth Annual Meeting." The publication is continuous. Total number of volumes, 12. There have been no special reports. Address, Burlington.

VIRGINIA

VIRGINIA STATE HORTICULTURAL SOCIETY. An annual report is issued by the society (which has state appropriation). The first report was published in 1898 under the title, "Annual Report of the Virginia State Horticultural Society." The publication is still continued under this title. The society issues four quarterly bulletins each year, the first issue containing a revised "Spray Calendar." Have also published "Fruit Growing in Virginia," and "Packing Apple Book." Address, Crozet.

WASHINGTON

WASHINGTON STATE HORTICULTURAL ASSOCIATION. Annual reports and bulletins are published by the society. The first report was issued in 1901 under the title, "Report of the Washington State Horticultural Association." The publication still continues under the same title. Total number of volumes, 9. There have been no special reports. Address, State Secretary's Office, Walla Walla.

WEST VIRGINIA

WEST VIRGINIA STATE HORTICULTURAL SOCIETY. Up to 1913 this society issued an annual report published by the State Board of Agriculture as one of its quarterlies. The first report was published in 1894 under the title, "Special Bulletin No. 2, State Experiment Station." The second, third, fourth and fifth annual meetings were reported in the "Farm Reporter" (no longer published), sixth, seventh and eighth in the "Farm Review" (no longer published), ninth in pamphlet form, tenth,

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eleventh and twelfth in "Farm Review," and the thirteenth to nineteenth have been issued by the State Board of Agriculture. The twentieth report is published by the Commissioner of Agriculture, as the Board of Agriculture has been disbanded. There have been no special reports. Address, Morgantown.

WISCONSIN

WISCONSIN STATE CRANBERRY GROWERS' ASSOCIATION. This association has issued twenty-seven annual reports and ten semi-annual reports. The first report was issued in 1887.

WISCONSIN STATE HORTICULTURAL SOCIETY. An annual report is published by the state. The first regular report was published in 1871 under the title, "Transactions of the Wisconsin State Horticultural Society." Beginning with the report for 1889, the publication bore the title, "Annual Report." Since 1910, the report has been issued in two parts: Part I, containing constitution, by-laws, business transactions and list of members which are for distribution to members only. In 1868, a report was published entitled, "Report for the years 1864–8, with a short historical sketch since its organization." This society also issues a monthly magazine entitled, "Wisconsin Horticulture," the first issue of which appeared in September, 1910. Between 1896 and 1903, a monthly periodical, entitled "The Wisconsin Horticulturist," was issued. Nineteen numbered bulletins have appeared between March, 1903, and April, 1910. Address, Madison.

WYOMING

WYOMING STATE BOARD OF HORTICULTURE. Biennial reports are issued. The first report was published in January, 1907, under the title, "Biennial Report of the Wyoming State Board of Horticulture." The publication is continued under the same title. Special bulletins, alternating with the reports, are published—four have been issued thus far,—1908, 1910, 1912, 1914. Address, Laramie.

WYOMING STATE HORTICULTURAL SOCIETY. Proceedings are issued in publications of the above board, those bearing the odd numbers in the biennial reports, and the others in the special bulletins.

North American horticultural periodicals.

The periodicals of any subject are supposed to chronicle all the fleeting events of the days and years, and to preserve them for future generations, but it is the most difficult thing to remember and record the journals themselves. Horticultural journals probably have lived and died in this country without having attracted the attention of a single library or collector of books. It is probably no exaggeration to say that more than 500 horticultural journals have been started in North America. There are more than sixty in continuance at the present moment.

The "Massachusetts Agricultural Repository" was started in 1793, but it was as late as 1821 that a horticultural department was added to it. This was an organ of a society rather than a journal in the present sense. American agricultural journalism is usually dated from the establishing of the original "American Farmer" in Baltimore in 1819. The first journal to devote any important extent of its space to horticultural matters was the original "New England Farmer," which was established in Boston in 1822, and which was one of the chief instruments in the organization of the Massachusetts Horticultural Society. Its first editor was Thomas G. Fessenden, author of the "New American Gardener," a book which appeared in 1828, and passed through at least six editions.

A "Floral Magazine" was started in Philadelphia in 1832 and continued sometime afterward. It contained colored plates of ornamental plants. The entire work, except the illustration, was done by the two David Landreths and it was published by them. Tradition says that it was not a paying venture and after several years it was discontinued. The volume of 1832 comprises eighty pages, with descriptions and colored illustrations of thirty-one stove and other ornamental plants. The full title is "The Floral Magazine and Botanical Repository. Published by D. & C. Landreth, Nursery and seedsmen, Philadelphia." The bound volume is 8¾ x 11 inches. The "Horticultural Register and Gardener's Magazine," established in Boston in 1835, and edited by Fessenden and Joseph Breck, and "Hovey's Magazine," were among the first distinct horticultural periodicals. The former, although a magazine of more than ordinary merit, did not persist long. The latter was founded by C. M. Hovey and P. B. Hovey, Jr., and was called the "American Gardener's Magazine and Register of Useful Discoveries and Improvements in Horticultural and Rural Affairs," a journal which, in the third volume, became the "Magazine of Horticulture," and which enjoyed an uninterrupted existence until 1868, thus covering a third of a century of one of the most critical and interesting periods in American horticulture.

The next important journalistic venture was the "Horticulturist," begun in July, 1846, and continued under many changes and vicissitudes for some thirty years, and was finally represented, in line of descent, by "American Gardening," which ceased to exist in November, 1904. The "Horticulturist" had been published in Albany, Rochester, Philadelphia and New York. The first seven volumes were edited by A. J. Downing; the eighth and ninth by Patrick Barry; the tenth by Barry and J. J. Smith; the eleventh to fourteenth by J. J. Smith; fifteenth and sixteenth by Peter B. Mead; seventeenth and eighteenth by Mead and G. E. Woodward. Later it was continued by Henry T. Williams, in New York, until the close of 1875, when the "Horticulturist" was united with the "Gardeners' Monthly," of Philadelphia. This latter magazine started January 1, 1859, as a quarto, but became an octavo with its second volume. It continued until the close of 1887, when, upon the death of its publisher, Charles Marat, it passed into the hands of "American Garden," New York. It had a long and useful career under the editorial management of one of the most accomplished and conscientious of American horticulturists, Thomas Meehan, whom all the succeeding generation had learned to love.

The "American Garden" as such, before it absorbed the "Gardeners' Monthly," traced an independent descent from two other journals. The senior of these was "The Ladies' Floral Cabinet," the first number of which was issued January 1, 1872, by H. T. Williams, who was also editor and publisher of the "Horticulturist," at 5 Beekman Street, New York. Mr. Williams' idea was that the cultivation of flowers properly belonged to women, that they were by nature eminently fitted for it, and that a journal adapted to their wants would greatly aid them in their work, and prove a financial success to the publisher. For some time "The Floral Cabinet" was well sustained and well edited, but after about three years Mr. Williams became wholly absorbed in religious publications and his interest was gradually withdrawn from floriculture. In January, 1880, the "Cabinet" and all the personal effects of Mr. Williams passed into the hands of Adams & Bishop, who continued the publication with varied success, and who intended to close up the business as soon as they could do so to the best advantage. In June, 1882, the paper and good will were sold to Ralph H. Waggoner, who gave it new life; he secured the services of C. L. Allen as an advisory editor, the active work falling upon Miss S. A. Fraser. The last number under Waggoner's management was issued January 1, 1887, when it was absorbed by the "American Garden." The other independent journal absorbed by "American Garden" was known as the "Flower Garden," and the first number was published October 1, 1872; it was edited by C. L. Allen, and published quarterly by C. L. Allen & Co., 76 Fulton Street, Brooklyn, N. Y. It existed one year and was then sold to Beach, Son & Co., seed and bulb merchants, who removed its publication office to Barclay Street, New York, and changed its name to "The American Garden," the late Mrs. C. V. Beach becoming its editor. Beach & Son continued the publication as a quarterly till the year 1880, when B. K. Bliss & Sons secured possession of both the paper and the seed business. It was at this epoch that F. M. Hexamer became editor. Two years later (1882) the

publication again became a monthly. In 1883, E. H. Libby secured possession of the property, but its publication was continued under the same editorial control till the end of 1885; during some part of this period the publication office was at Greenfield, Mass. Things stood as they were till 1890, when the magazine shape was adopted. In that year, L. H. Bailey became editor and continued in that capacity till 1893. In January, 1892, soon after the absorption of "Popular Gardening," of Buffalo, N. Y., the title was altered to "American Gardening," so as to unite and typify both names. Prior to this amalgamation, after having had a career of seven years under Elias A. Long, its founder, "Popular Gardening" had absorbed many minor magazines. For a time E. A. Long, in association with T. Greiner, edited the combined journal. After 1893, Leonard Barron assumed the editorship, the periodical having been taken over by the A. T. De La Mare Publishing Company, publishers of "The Florists' Exchange." In October, 1898, James Withers took over the publication. The American Gardening Publishing Company succeeded to the ownership in 1901. In 1903, the American Gardening Co., was organized, the business manager being Thomas B. Meehan; and with this organization the regular continuity of the periodical as a general horticultural magazine came to a close. The "Fruit Grower" of St. Joseph, Mo., took over the mailing list.

The "Philadelphia Florist" completed its first volume in 1852–3. The subsequent volumes (at least three) were known as the "Florist and Horticultural Journal." It was a very creditable monthly magazine, with colored plates. An early journal in the new West was Hooper and Elliott's "Western Farmer and Gardener," Cincinnati, September, 1839–45, with plates colored by hand.

The first pomological journal was probably Hoffy's "Orchardist's Companion," a quarterly, established in Philadelphia in 1841, and edited by Dr. Brincklé. It was a pretentious quarto, with colored plates, of which only one volume was issued. This was followed in 1860 by the "North American Pomologist" by Dr. Brincklé, an abler publication than the other. Other early horticultural periodicals were "Western Horticultural Review," Cincinnati, 1851–3, edited by John A. Warder; "American Journal of Horticulture," later known as "Tilton's Journal of Horticulture," Boston, 1867–71 (9 vols.), edited in its last three years by the younger Robert Manning; "Western Pomologist," Des Moines, Iowa, and Leavenworth, Kansas, 1870–72, by Mark Miller, J. Stayman, and others. The first attempt to establish a weekly, after the pattern of the great English journals, was "Garden and Forest," which appeared in New York in 1888, under the management of Professor Charles S. Sargent, of Harvard University. This journal continued till the close of 1897, comprising ten completed volumes of very high character and entitled to rank as one of the noteworthy undertakings in the entire field (see *Styles*, p. 1597). Probably the first journal devoted to a particular fruit or plant was Husmann's "Grape Culturist," St. Louis, 1869–71.

The first florists' trade paper to persist is "The American Florist," issued August 15, 1885; this was followed by "Florists' Exchange," in 1889; and "Florists' Review," 1895. "Horticulture," established 1904, is also practically a trade paper. All of these are continuing.

On the Pacific coast, the earliest distinct horticultural periodical was the "California Culturist," the first number of which appeared in January, 1859. This ran through four volumes, and it records the marvels of the first era of modern fruit-growing upon the Pacific slope. Before this, however, "The California Farmer," had been established (January, 1854). It maintained a spasmodic existence for a number of years, and printed the first pomological and horticultural reports of committees. "The Pacific Rural Press" was established in 1871, in San Francisco, and still continues, devoted very largely to the horticultural interests. The "California Horticulturist" was established in 1870, and ran through ten yearly volumes, when, in 1880, it was merged into "The Pacific Rural Press." "The Rural Californian," of Los Angeles, still in existence, was established in 1877. "The California Fruit-Grower," commenced in 1888, still survives (1912) as "The California Fruit News." "The California Florist," first issued in Santa Barbara, then in San Francisco, began in May, 1888, and stopped in 1889. "The California Cultivator," of Los Angeles, established in 1884, is still published. See pages 1507, 1508 for further discussion of California journals.

EXTANT HORTICULTURAL JOURNALS
(With Date of Establishment)

IN CANADA

British Columbia Fruit and Farm Magazine. John Nelson, ed. M. 1909. Vancouver, B. C.

The Canadian Florist. H. B. Cowan, ed. Pub. by Horticultural Publishing Company. Every second Friday. $1. 1903. Peterboro, Ont.

The Canadian Horticulturist. H. B. Cowan, ed. Pub. by Horticultural Publishing Company. M. $1. 1878. Peterboro, Ont.

Fruit Grower and Farmer. James A. Livingston. S.-M. $1. 1907. Grimsby, Ont. (Formerly "Fruit Grower, Market Gardener and Poultryman.")

Le Journal d'Agriculture et d'Horticulture. Pub. by Minister of Agriculture of Quebec. H. Nagant, ed. M. $1. 1879. Quebec, Que.

Manitoba Horticulturist. Published by Manitoba Horticultural and Forestry Associations. M. $1. 1914. Winnipeg.

Maritime Apple. 1912. Kentville, N. S.

IN THE UNITED STATES

Acker und Gartenbauzeitung. The Herold Company. W. $1. 1869. Milwaukee, Wis.

American Florist. The American Florist Company, ed. and pub. W. $1. (Canadian subscription, $2.) 1885. Chicago, Ill.

American Fruit and Nut Journal. H. Harold Hume. S-Q. $1. 1904. Petersburg, Va.

American Fruits. R. T. Olcott. M. $1.50. 1903. Rochester, N. Y.

American Nut Journal. R. T. Olcott. M. $1.25. 1914. Rochester, N. Y.

American Pomologist. Pub. by American Pomological Society. Q. 45 cts.

Apple World, The. U. G. Border. M. $1. 1914. Baltimore. Md. Official organ of the Apple Advertisers of America.

Arkansas Fruits and Farms. E. N. Hopkins. Fort Smith, Ark. (First appeared under title "Ozark Produce Journal," then "Ozark Fruits and Farms.")

Better Fruit. E. H. Shepard. M. $1. 1906. Hood River, Ore.

California Cultivator. C. B. Messenger, ed. W. $1. 1884. Los Angeles.

California Fruit News. H. C. Rowley, ed. and pub. W. $3. 1888. San Francisco. (Formerly "California Fruit Grower.")

California Garden. Alfred D. Robinson, ed. M. $1. 1908. San Diego, Calif.

Carolina Fruit and Trucker's Journal. Z. W. & W. S. Whitehead. S-M. $1. 1897. Wilmington, N. C.

Eastern Fruit. S. M. Paschall. M. 50 cts. 1912. Philadelphia.

Farm and Orchard. R. W. Thrush, ed. M. $1 for 3 yrs. 1913. Keyser, W. Va.

Florida Grower. Florida Grower Publishing Company. W. $1.50. 1908. Tampa, Fla.

Florists' Exchange, The. A. T. De La Mare Printing and Publishing Co. W. $1. 1888. New York.

Florists' Review. H. B. Howard, ed. W. $1. 1897. Chicago, Ill.

Fruit and Produce Distributor. Distributor Publishing Co. W. $2. 1913. Portland, Ore.

Fruit Belt. Geo. W. Welsh. M. 50 cts. 1905. Grand Rapids, Mich.

Fruitman and Gardener. L. McCutcheon, ed. and pub. M. 50 cts. 1897. Mount Vernon, Iowa.

Fruitman's Guide. Fruitman's Guide, Inc. W. $1. 1896. New York.

Fruit Grower and Farmer. W. G. Campbell, ed. M. $1. 1897. St. Joseph, Mo. (Known as "Western Fruit Grower" until October, 1912.)

Fruit Trade Journal and Produce Record. Fruit Trade Journal Company. W. $1. 1889. New York.

Gardeners' Chronicle of America, The. Chronicle Press, Inc. M. $1.50. 1905. Madison, N. J.

Gardening. The Gardening Company, ed. and pub. S-M. $2. 1892. Chicago, Ill.

Garden Magazine. Doubleday, Page & Co. M. $1.50. 1905. Garden City, N. Y.

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GREEN'S FRUIT GROWER. Chas. A. Green, ed. M. 50 cts. 1881. Rochester, N. Y.

GULF COAST CITRUS FRUIT GROWER AND SOUTHERN NURSERYMAN. Albert S. Leecraft. M. $1. December, 1910. Houston, Texas.

HORTICULTURE. W. J. Stewart. W. $1. 1904. Boston.

HOUSE AND GARDEN. McBride, Nast & Co. M. $3. 1901. New York, N. Y.

ILLINOIS HORTICULTURE. Pub. by Illinois State Horticultural Society. Q. 1913. Normal.

INTERMOUNTAIN FRUIT JOURNAL AND INTENSIVE AGRICULTURIST. R. E. Turpin, ed. Alfred Patek, pub. $1. 1910. Grand Junction and Denver, Colo. (Now consolidated with "Western Farm Life.")

LANDSCAPE ARCHITECTURE. Official organ of the American Society of Landscape Architects. Published by Lay, Hubbard and Wheelright. Q. $2. 1910. New York.

MARKET GROWERS' JOURNAL. S. W. Severance. S.-M. $1. 1907, Louisville, Ky.

MICHIGAN HORTICULTURE. Pub. by Michigan State Horticultural Society. M.

MINNESOTA HORTICULTURIST. Minnesota State Horticultural Society. M. $1. 1894. Minneapolis, Minn.

MODERN GLADIOLUS GROWER, THE. Madison Cooper, ed. and pub. M. 50 cts. 1914. Calcium, N. Y.

NATIONAL NURSERYMAN. National Nurseryman Publishing Co., Inc. M. $1. 1893. Rochester, N. Y.

NEBRASKA HORTICULTURE. Published by Nebraska State Horticultural Society. M. $1. 1911. Lincoln.

NORTHERN FRUIT GROWER. M. 1911. Howard Lake, Minn.

NORTHWEST FARM AND ORCHARD. R. E. White. M. 50 cts. Spokane, Wash.

NORTHWEST HORTICULTURIST AND DAIRYMAN. C. A. Tonneson, ed. and pub. M. 50 cts. 1888. Tacoma, Wash.

NUT-GROWER. J. F. Wilson. M. $1. 1902. Waycross, Ga.

ORCHARD AND FARM IRRIGATION. A. Dixon. M. $1. 1886. San Francisco, Calif. (Formerly "Orchard and Farm.")

PACIFIC FRUIT WORLD. M. V. Hartranft. W. $2. 1895. Los Angeles, Calif.

PACIFIC GARDEN. P. D. Barnhart, ed. M. $1. 1907. Pasadena, Calif.

PARK AND CEMETERY AND LANDSCAPE GARDENING. Allied Arts Publishing Co. M. $2. 1891. Chicago, Ill.

PARK'S FLORAL MAGAZINE. Geo. W. Park. M. 10 cts. 1871. La Park, Pa.

PEACH GROWERS' JOURNAL AND APPLE TRADE REVIEW. W. John Hinchey, ed. and pub. M. $1. 1899. Middleport, N. Y.

SOUTHERN FRUIT GROWER, THE. R. S. Walker, ed. M. 50 cts. 1896. Chattanooga, Tenn.

SOUTHERN ORCHARDS AND FARMS. J. W. Canada. M. 50 cts. 1907. Houston, Texas. (First appeared under title "Texas Fruits." From 1909–11 had the title "Southern Orchard and Homes.") Now appears under title "Southland Farmer," La Porte, Texas.

TREE GOLD. Benjamin W. Douglass, ed. M. 50 cts. 1914. Indianapolis, Ind.

TRUCKER AND FARMER. H. J. Hill, ed. M. $1. 1906. New Orleans, La. (Now "Modern Farming." A. B. Gilmore, ed. Established 1870.)

TRUCK FARMER OF TEXAS. J. C. Loving. M. $1. 1899. Dallas.

VEGETABLE GROWER. H. L. Freking, ed. M. 50 cts. 1911. Spencer, Ind.

WISCONSIN HORTICULTURE. Pub. by the Wisconsin State Horticultural Society. M. 1910. Madison.

EXTINCT HORTICULTURAL JOURNALS

IN CANADA

ACADIAN ORCHARDIST. H. G. Harris, ed. and pub. W. $1. 1873. Kentville, N. S.

COURIER AND OKANAGAN ORCHARDIST. Geo. C. Rose, ed. and pub. W. $1.50. 1904. Kelowna, B. C.

FARM AND GARDEN CULTURIST. Richard Burke, ed. 1888–9. P. E. I.

POULTRY, GARDEN AND HOME ADVOCATE. H. B. Donovan. M. 50 cts. 1898. Toronto, Ont. (Now "Poultry Advocate.")

IN THE UNITED STATES

AMERICAN FARM AND HORTICULTURIST. L. J. Thompson. Q. 25 cts. 1889–94. Lakewood, Ohio. Pub. at Richmond, Va., from 1891–93.

AMERICAN FARM AND ORCHARD. W. D. Bassford, ed. M. 1901–6. Mexico, Mo.

AMERICAN FRUIT AND FARM. American Publishing Company. M. $1. 1908. Paonia, Colo.

AMERICAN GARDEN. F. M. Hexamer and others. M. 1874–91. New York, N. Y.

AMERICAN GARDENING. Rural Publishing Company. $1. M. 1892–1904. New York. (Merged into "Western Fruit Grower" now "Fruit Grower.")

AMERICAN HORTICULTURAL ADVERTISER.

AMERICAN HORTICULTURIST. Leavenworth & Burr Co. M. $1. 1885–6. Detroit, Mich. (Established as "Michigan Horticulturist." Combined with "Popular Gardening.")

AMERICAN HORTICULTURIST. M. 1891–8. Wichita, Kans. (Established as "Smith's Small Fruit Farmer.")

AMERICAN HORTICULTURIST. W. Douglas, ed. W. $1.50. 1910–11. Fowler, Ind.

AMERICAN JOURNAL OF HORTICULTURE AND FLORISTS' COMPANION. 1867. (Later changed to "Tilton's Journal of Horticulture.")

AMERICAN TRUCK FARMER. W. T. Burkam, ed. M. October, 1903 to December, 1905. St. Louis, Mo. (Changed to "Farm Money-Maker.")

APPLE SPECIALIST. James McKinnay. M. 50 cts. 1903–8. Quincy, Ill. (Merged into "Green's Fruit Grower.")

ARKANSAS FRUITS. D. E. Debou, ed. 50 cts. 1912–14. Fayetteville, Ark. (Now merged with "Arkansas Fruits and Farms.")

BOSTON FLOWER MARKET AND NEW ENGLAND FLORIST. (Changed to "New England Florist ")

BOWDITCH'S AMERICAN FLORIST AND FARMER. M. 1881–5. Boston. (Merged into "Orchard and Garden.")

CACTUS JOURNAL. M. 1894–8. Baltimore, Md.

CALIFORNIA CULTURIST. M. 1858–63. San Francisco.

CALIFORNIA FLORIST AND GARDENER. E. E. Smith, ed. M. 1888–9. San Francisco. (Merged into "Pacific Rural Press.")

CALIFORNIA FRUIT EXPORTER. Scott & Wood. M. $1. 1891. San Francisco.

CALIFORNIA HORTICULTURIST. M. 1871–80. (Merged into "Pacific Rural Press.")

CENTRAL STATES FRUIT GROWER. 1896–9. (Later "National Fruit Grower.")

CITROGRAPH. Redlands, Calif.

COLORADO FRUIT GROWER. Paonia and Grand Junction, Colo. (Title changed to "Irrigation Fruit Grower.")

CRANBERRY GROWER. W. H. Fitch, ed. M. $1. 1903–5. Cranmoor, Wis.

DAHLIA NEWS. New England Dahlia Society. M. $1. 1907–11. Boston.

EASTERN NEW YORK HORTICULTURIST. Q. 1897–9. Chatham, N. Y.

EASTERN SHORE FARMER AND FRUIT CULTURIST. M. 1893–1902. Salisbury, Md., and Georgetown, Del. (Established in 1893 as the "Strawberry Culturist.")

FANCY FRUIT. Granville Lowther, ed. and pub. M. $1. 1907-9. North Yakima, Wash. (Later changed to "Washington Fruit Grower.")

FARMER AND FRUIT GROWER. Florida Publishing Co. W. Jacksonville, Fla.

FARM, GARDEN AND POULTRY. Farm, Garden and Poultry Company. M. 50 cts. 1902. Hammonton, N. J.

FIELD, LAWN AND GARDEN. W. B. Davis, ed. M. 1874–5. Madison, Wis.

FLORAL INSTRUCTOR. M. 1880–91. Ainsworth, Iowa.

FLORAL LIFE. Young & Bennett Co. M. 50 cts. 1903–8. Springfield, Ohio. (Merged into "Household Journal and Floral Life.")

FLORAL MAGAZINE. John Lewis Childs. Floral Park, N. Y.

FLORIST AND HORTICULTURAL JOURNAL. H. C. Hanson. M. 1852–5. Philadelphia. (Established as "Philadelphia Florist and Horticultural Journal.")

FLOWER GARDEN, THE. 1872–4. Brooklyn, N. Y.

FLOWERS, F. W. Stack, ed. Pub. by Suburban Press. M. $1. 1912. New York.

FRUIT AND GRAPE GROWER. A. R. Blakey, ed. M. $1. 1886–9. Charlotteville, Va.

FRUIT AND VEGETABLE GROWER. M. 1889–90. Cheswold, Del.

FRUIT GROWER. W. $2. 1892. Macon, Ga.

FRUIT GROWER AND HORTICULTURIST. E. R. McKenny, ed. M. $1. 1890–1. Lacon, Ill.

FRUIT GROWER'S JOURNAL. O. O. Buck, ed. and pub. W. from 1883–6.; S.-M. from 1887–1907; M. 1908. 50 cts. 1883. Pub. at Cobden, Ill., 1883–1907; at Treynor, Iowa. 1908. (Merged into "Green's Fruit Grower.")

FRUIT RECORDER AND COTTAGE GARDENER. A M. Purdy. M. $1. 1869–86. Palmyra, N. Y. (Established as "Small Fruit Recorder and Cottage Gardener." Absorbed by "Popular Gardening.")

FRUITS AND FLOWERS. D. H. Stearns, pub. M. $2. 1891–2. Portland, Ore.

FRUITS AND FLOWERS. A. W. Dyer. M. 10 cts. 1906. Chautauqua, N. Y. (Absorbed by the "Vegetable Grower.")

GARDEN AND FOREST. C. S. Sargent. W. $4. 1888–97. New York, N. Y.

GARDENERS' MAGAZINE. Joseph Breck. 1835. Boston.

GARDENERS' MAGAZINE. M. 1854–5. Boston.

GARDENERS' MONTHLY. Thomas Meehan. M. January 8, 1859 to January, 1888. Philadelphia. (Absorbed by "American Garden.")

GRAPE CULTURIST. Geo. Husmann. M. 1869–71. St. Louis, Mo.

HOME AND FLOWERS. M. 1896–1904. Springfield, Ohio. (Established as "How to Grow Flowers." Continued under following title.)

HOME AND FLOWERS, formerly "How to Grow Flowers," consolidated with "Success with Flowers." M. 1890–1906. West Grove, Pa. (Established as "Success with Flowers." Merged into "Vick's Magazine.")

HOME FLORIST. Q. 1898–1901. Springfield, Ohio. (Merged into "Home and Flowers.")

HORTICULTURAL ART JOURNAL. T. B. Jenkins, ed. $2. 1886–91. Rochester, N. Y.

HORTICULTURAL MARKETPLACE. John S. Gallagher. W. September, 1910, to October 31, 1910. Rochester, N. Y.

HORTICULTURAL REGISTER. Thomas G. Fessenden. M. 1835–9. Boston.

HORTICULTURAL REVIEW AND BOTANICAL MAGAZINE. J. A. Warder, ed. M. 1853–4. Cincinnati, Ohio. (Established as "Western Horticultural Reveiw.")

HORTICULTURAL VISITOR. (See "Our Horticultural Visitor.")

HORTICULTURIST. A. J. Downing and others. M. 1846–75. Albany, Rochester, Philadelphia and New York. (United with "Gardeners' Monthly.")

HOUSEHOLD JOURNAL AND FLORAL LIFE. W. A. Martin, ed. M. 25 cts. 1903. Central Publishing Company, Springfield, Ohio.

HOVEY'S MAGAZINE OF HORTICULTURE. C. M. Hovey. M. 1835–68. Boston. Seems never to have had this title on title page. Title: 1835–6, "American Gardeners' Magazine and Register of Useful Arts;" 1837–68, "The Magazine of Horticulture, Botany and all Useful Discoveries and Improvements in Rural Affairs." United with "American Journal of Horticulture" to form "Tilton's Journal of Horticulture.").

HOW TO GROW FLOWERS. 1896–1900. (Title changed to "Home and Flowers.")

INTERNATIONAL HORTICULTURIST. 1889. Harrisburg, Pa.

IOWA HORTICULTURE. Pub. by State Horticultural Society. M. Des Moines. January to December, 1908.

IRRIGATION FRUIT GROWER. R. H. Perry, ed. M. $1. 1905–11. Denver, Colo. (Established as "Western Slope Fruit Grower;" then as "Colorado Fruit Grower." Absorbed by "Intermountain Fruit Journal.")

LADIES FLORAL CABINET. M. 1872 to January 7, 1887. New York. (United with "American Garden.")

LADIES HORTICULTURAL MAGAZINE AND FLORAL REGISTER. M. Baltimore, Md. (Prospectus issued in June, 1833.)

LEWISTON ORCHARDS LIFE. H. H. S. Rowell, ed. M. 50 cts. 1912–14. Lewiston, Idaho.

MAGAZINE OF GARDENING AND BOTANY. M. 1834. Baltimore, Md.

MAGAZINE OF HORTICULTURE, BOTANY AND ALL USEFUL DISCOVERIES AND IMPROVEMENTS IN RURAL AFFAIRS. (See "Hovey's Magazine of Horticulture.")

THE MARKET GARDEN. Market Garden Publishing Company. M. 50 cts. First number published in January, 1894, and in July and in October the regular monthly journal began. Discontinued 1906. Minneapolis, Minn.

MAYFLOWER. J. L. Childs. M. 50 cts. 1885-1906. Pub. at Floral, N. Y. 1885–6; Queens, N. Y. 1887–8; Floral Park, N. Y. 1889–1906. (Merged in "Floral Life.")

MEEHAN'S GARDEN BULLETIN. S. M. Meehan. M. $1. 1909–13. Germantown, Pa.

MEEHAN'S MONTHLY. T. Meehan. M. $2. 1891–1902. Germantown, Pa.

MICHIGAN FRUIT GROWER. Pub. by Practical Farmer Company. W. 1893–9. Grand Rapids, Mich. 1893–6 "Practical Farmer and Fruit-Grower."

MICHIGAN HORTICULTURIST. Chas. W. Garfield, ed. W. H. Burt Publishing Company, pub. M. 1885–6. Detroit, Mich. (Title changed to "American Horticulturist.")

MISSOURI AND ARKANSAS FARMER AND FRUITMAN. R. J. Profitt. M. 50 cts. 1888. Kansas City, Mo. (From 1888–94 had title "Kansas City Progress and Western Farm Journal.")

MONTANA FRUIT GROWER. 1896–1901. Missoula.

NATIONAL FRUIT GROWER. Fruit Grower Publishing Company. M. 50 cts. 1894–1910. St. Joseph, Mo. (From 1896–9 had title "Central States Fruit Grower.")

NATIONAL FRUIT GROWER. Chas. Greening. Monroe, Mich. (1896–9 "Central States Fruit-Grower.")

NATIONAL HORTICULTURIST. Q. 1890–3. Cambridge, Md.

NATIONAL HORTICULTURIST. National Horticulturist Company. M. $1. 1909 to March, 1912. Council Bluffs, Iowa.

NEBRASKA HORTICULTURIST. J. G. Carpenter. Q. 25 cts. 1883–93. Blower, Neb.

NEW ENGLAND FLORIST. New England Florist Company. W. 1896–9. Boston. (Established as "Boston Flower Market and New England Florist.")

NEW YORK HORTICULTURAL REVIEW. 1855. New York.

NORTH AMERICAN HORTICULTURIST. M. 50 cts. 1895–1907. Monroe, Mich.

ORANGE BELT. L. M. Holt. M. $2. 1890–4. Pub. at Alessandro, Calif. 1890–2; Rialto, 1893; Los Angeles, 1894. A weekly edition began in 1893 as "The Orange Grower."

ORCHARD AND GARDEN. J. T. Lovett Company, pub. M. 50 cts. 1879–92. Little Silver, N. J.

ORCHARD FRUITS. Wm. Dyke. M. 50 cts. 1892–3. Effingham, Ill.

ORCHARDISTS' COMPANION. A. Hoffy. Q. 1841–2. Philadelphia.

ORNAMENTAL AND FOREST TREE GROWER. J. J. Pinney. M. 50 cts. Evergreen, Wis.

OUR HORTICULTURAL VISITOR. C. G. Mendenhall, ed. M. 50 cts. 1895–1906. Kinmundy, Ill. (First number had title, "Southern Illinois Horticultural Visitor"; 1895–1901, "Horticultural Visitor.")

PACIFIC TREE AND VINE. 1882. San José, Calif.

PEACH GROWER. Mr. Bryan, ed. and pub. Savannah, Ga.

PEACH GROWER, FRUIT CULTURIST AND TRUCKERS' MAGAZINE. R. M. Martin, ed. and pub. M. 50 cts. 1903–1909. Savannah, Ga.

PHILADELPHIA FLORIST AND HORTICULTURIST JOURNAL. R. R. Scott, ed. 1852–3. (Continued as "Florist and Horticultural Journal.")

PILOT POINT HORTICULTURIST. M. Pilot Point, Texas.

POPULAR GARDENING AND FRUIT GROWING. Elias A. Long. M. 1885–91. Buffalo, N. Y. (Combined with "American Garden.")

PRACTICAL FARMER AND FRUIT-GROWER. (See "Michigan Fruit Grower.")

PRACTICAL FRUIT GROWER. G. A. Atwood. M. 1894–1907. Springfield, Mo. (From 1894–1900 had title, "The Southwest." Merged into "American Fruit and Nut Journal.")

PRACTICAL NURSERYMAN AND HORTICULTURAL ADVERTISER. M. 1893–1902. Huntsville, Ala.

PROGRESSIVE EASTERN FRUIT GROWER. John S. Gallagher. 1910–11. Rochester, N. Y.

PURDY'S FRUIT RECORDER AND EVAPORATOR. A. W. Purdy. Q. 25 cts. 1889–94. Palmyra, N. Y.

ROGUE RIVER FRUIT GROWER. Charles Meserve. M. $1. 1909–12. Medford, Ore.

ROSE JOURNAL. Published by the American Rose Society. Q. 1912–13. Fishkill-on-Hudson, N. Y.

SCIENCE AND HORTICULTURE. C. R. Orcutt. M. $2. Orcutt, Calif. Also pub. at Los Angeles and San Diego.

SEED TIME AND HARVEST. Isaac F. Tillinghast. M. (1880–2, Q.) 25 cts. 1880–94. La Plume, Pa. (Merged in "American Farmer and Farm News.")

SEED TIME AND HARVEST. W. 1897–8. Scranton, Pa.

SEED TIME AND HARVEST. M. 1905–8. Scranton, Pa.

SMALL FRUIT RECORDER AND COTTAGE GARDENER. 1869–71. (Later "Fruit Recorder and Cottage Gardener.")

SMITH'S SMALL FRUIT FARMER. B. F. Smith. Q. 50 cts. 1891–4. Lawrence, Kans. (Later "American Horticulturist).

SOUTHERN CALIFORNIA HORTICULTURIST. Southern California Horticultural Society. M. 1877–9. Los Angeles. (Followed by "Semi-Tropic California;" then united with "Rural Californian.")

SOUTHERN FLORAL MAGAZINE. Morton & Titus. M. 50 cts. Clarksville, Tenn.

SOUTHERN FLORIST AND GARDENER. M. 1894–9. Louisville, Ky. 1894–7; Chattanooga, Tenn., 1898–9.

SOUTHERN FRUIT JOURNAL. James Harrison, ed. and pub. M. 50 cts. 1904. Montezuma, Ga.

SOUTHERN HORTICULTURAL JOURNAL. S-M. 1888–91. Denison, Texas.

SOUTHERN HORTICULTURIST. H. A. Swasey, ed. M. 1869–70. Canton, Miss., January and February, 1869; Yazoo City, Miss., March, 1869, to August, 1870; Tangipahoa, La., October to Dec., 1870. (Continued as "Swasey's Southern Gardener.")

SOUTHERN HORTICULTURIST. M. 1892. Humboldt, Tenn.

SOUTHERN HORTICULTURIST. M. Denison and Ft. Worth, Texas.

SOUTHERN ILLINOIS HORTICULTURAL VISITOR. (See "Our Horticultural Visitor.")

STRAWBERRY. R. M. Kellogg Company. M. $1. 1906–7. Three Rivers, Mich. (Merged into "Fruitman and Gardener.")

STRAWBERRY CULTURIST. (Changed to "Eastern Shore Farmer and Fruit Culturist.")

STRAWBERRY SPECIALIST. O. W. Blacknall. M. 50 cts. 1897–1903. Kittrell, N. C.

SUCCESS WITH FLOWERS. Dingee & Conard Co. M. 25 cts. 1890 to June, 1904. West Grove, Pa. (Combined with "Home and Flowers.")

SWASEY'S SOUTHERN GARDENER. H. A. Swasey, ed. M. 1871. Tangipahoa, La. (Established as "Southern Horticulturist.")

TEXAS FRUITS, NUTS, BERRIES AND FLOWERS. (Now "Southern Orchards and Farms.")

TILTON'S JOURNAL OF HORTICULTURE AND FLORISTS' COMPANION. 1867–71. Boston. (Formerly "American Journal of Horticulture and Florists' Companion.")

TRADE JOURNAL AND INTERNATIONAL HORTICULTURIST. M. New York, N. Y.

TRI-STATE FARMER AND GARDENER. Tri-state Publishing Company. M. 50 cts. 1895–1907. Chattanooga, Tenn.

VICK'S MAGAZINE. Vick's Magazine Company. M. 50 cts. 1878–1906. Rochester, N. Y. Has also been pub. at Dansville, N. Y., and Chicago.

VINEYARDIST. J. H. Butler. S-M. $1. 1886–1903. Penn Yan, N. Y.

WASHINGTON FRUIT GROWER. E. L. Rorrey, ed. 1907–10. North Yakima, Wash. (Originally pub. under title, "Fancy Fruit.")

WESTERN FARMER AND GARDENER. Hooper & Elliott. 1839–45. Cincinnati, Ohio.

WESTERN GARDEN. C. N. Page. 1890–6. M. Des Moines, Iowa. (Is now published as "Poultry Success.")

WESTERN GARDEN. 1893–4. Denver, Colo.

WESTERN HORTICULTURAL REVIEW. J. A. Warder, ed. M. 1850–3. Cincinnati, Ohio. (Continued as "Horticultural Review and Botanical Magazine.")

WESTERN NEW YORK APPLE. L. P. McNeeley. M. $1.50. 1908. Barker, N. Y.

WESTERN POMOLOGIST. Mark Miller, Dr. Stayman and others. 1870–2. Des Moines, Iowa, and Leavenworth, Kans. (Combined with "The Horticulturist.")

WESTERN SLOPE FRUIT GROWER. Paonia, Colo. (See "Irrigation Fruit Grower.").

WISCONSIN HORTICULTURIST. Pub. by Wisconsin State Horticultural Society. M. 1896–1903. From 1896–1902 pub. at Baraboo and Madison; 1903 at Sparta and Madison.

WOODSMAN. Geo. W. Caldwell. M. 50 cts. Evergreen, Wis.

HORTICULTURISTS, NORTH AMERICAN. At this place are brought together brief biographical statements on persons not now living who have been eminent in horticulture in any of its branches in the United States and Canada. It is intended to include those who, by their own efforts, have had marked influence of a national scope, or at least an influence extending beyond state or provincial boundaries, in developing horticultural thought and practice as cultivators, tradesmen, authors, teachers, experimenters. As there is no standard list of such persons, or no recognized basis of judgment, so the present account is undoubtedly incomplete, and it may lack in uniformity. No doubt many other names should have been included; but the present list represents a large correspondence extending over nearly three years, and it is as extensive as circumstances will permit. It is particularly to be understood that this set of biographies does not attempt to constitute any standard by which the merits of individual horticulturists are to be judged. It does not represent an editorial judgment of persons who should finally be included in such lists, but only a collection of data of interest and value so far as it goes. There is need of a standard biographical work on American men and women who have been eminent and prominent in the development of agriculture in its widest sense; it is hoped that these biographies, and those contained in the fourth volume of the "Cyclopedia of American Agriculture," will be of service to editors who come finally to prepare such a work.

Adlum, John (Fig. 1868), grape experimenter, and author of "Memoir on the Cultivation of the Vine," 1823 and 1828, the first separately published American grape book, was born in York, Pa., April 29, 1759, and died at Georgetown, D. C., March 1, 1836. He was a soldier in the Revolution, major in the provisional army in the administration of the elder Adams, and later a brigadier-general in the militia of Pennsylvania. He was also a surveyor and civil engineer. He also held an associate judgeship in Lycoming County, Pennsylvania, having been appointed by Governor Mifflin. He was a friend of Priestly, and endeavored to apply the scientific knowledge of his time to agriculture. He early became interested in the amelioration of the native grapes, and established an experimental vineyard in the District of Columbia. He endeavored, but without success, to secure the use of certain public land in Washington for the purpose of "cultivating an experimental farm." He brought the Catawba grape to public notice. He was a pioneer in the awakening industrial activity of the new country. The botanist, Rafinesque, commemorated his name in the pretty genus Adlumia; but otherwise he has remained practically unknown until very recently. For further information, see Bailey, "Evolution of our Native Fruits." L. H. B.

1868. John Adlum.

Allen, Charles Linnæus, seedsman, florist and author, was born in Union Springs, New York, in 1828 and died at Floral Park, Long Island, May 21, 1909. He early evinced a love for flowers, especially the tree peony and gladioli when they were considered novelties in this country, and he soon made a horticultural and business specialty of these. At this time he lived in Brooklyn, New York, and was a communicant of Plymouth Church. He was superintendent of the Sunday-school for a number of years when Henry Ward Beecher was pastor of the church. Mr. Allen's pleasing ways and love for the children made him well fitted for the work. He was genial by nature, a pleasing conversationalist and a clever writer, an entertaining speaker, and devout churchman. In the early seventies he engaged in the wholesale seed trade at Queens, Long Island, under the firm name of C. L. Allen & Co., and erected an extensive plant for that day and time. The industry did not flourish as he had expected, and the seed business was sold to Hallock & Thorpe, a firm well known to the trade for many years. Mr. Allen then removed to Garden City, Long Island, and engaged to grow flower and vegetable seed by contract for many of the seedsmen, and it is here that he gained an international reputation as a scientific specialist on the culture of cabbage and cauliflower. His fame as a seedsman became worldwide. He wrote several books on horticultural subjects that were pleasing and practical and therefore popular. He spent his last years at Floral Park, New York, and was in great demand as a public speaker for horticultural organizations.

Mr. Allen possessed one of the finest private horticultural libraries in this country, many of the volumes of European origin and of rare merit, some tracing back to Holland and to 1497. Mr. Allen was a scholar and a linguist, and enjoyed the wealth of horticultural literature to the fullest extent. He was widely appreciated for his wisdom, geniality and his comradeship.

G. B. Brackett.

Ames, Frederick Lothrop, of the fourth generation of a family distinguished in the history of Massachusetts enterprise, was born in North Easton, in that state, June 8, 1835, and died September 13, 1893. He was graduated from Harvard College in the class of 1854, and devoted his life to the management of great commercial and industrial interests. Business did not occupy all his attention; he was a Fellow of Harvard College, a trustee of the Massachusetts Society for Promoting Agriculture, and of the Museum of Fine Arts; and an active and faithful director of charitable and benevolent institutions. A munificent patron of arts and sciences, he was successful in stimulating the increase of knowledge in many fields of human research. Devoted through his whole life to horticulture, he gained distinction for his wide and accurate knowledge of tropical orchids and their cultivation, and his collection of these plants at his country place in his native town was the most complete in the New World. His important services to botany and horticulture are commemorated in *Lælia Amesiana, Lælia anceps* var. *Amesiana, Phalænopsis F. L. Ames, Cypripedium Amesianum, Cypripedium insigne* var. *Amesianum, Vanda Amesiana, Stanhopea Amesiana, Miltonia vexillaria* var. *Amesiana, Odontoglossum Rossiæ* var. *Amesiana,* and *Cattleya Hardyana* var. *Amesiana.*

C. S. Sargent.

Appleseed, Johnny, an interesting and eccentric character, who sowed apple seeds in the wilds of Ohio and Indiana between 1801 and 1847. His real name was Jonathan Chapman. He was born in Boston in 1775, and died in 1847. For forty-six years he walked barefoot through the wilderness, and was never harmed by snakes, wild animals, or Indians. He was often clad in a coffee-sack, in which he made holes for the arms and legs. He would never kill any creature, and considered pruning and grafting wicked. Swedenborg and the New Testament he read aloud in many frontier log cabins. He had many peculiarities, but was always welcomed and respected everywhere. In the war of

1812 he saved many lives by warning the settlers of Hull's surrender and the approach of the Indians. He lived to see trees bearing fruit over a territory of 100,000 sq. mi. The story of this self-sacrificing and useful man is told by W. D. Haley in Harper's, 43:830–836 (1871). A movement is on foot in Ohio to erect a monument to Johnny Appleseed. His history has been the subject of a romance, "The Quest of John Chapman," by Newell Dwight Hillis, 1904. WILHELM MILLER.

Arnold, Charles, nurseryman and hybridist, was born in Bedfordshire, England, in 1818. In 1833 he removed to Paris, Ontario, and in 1853 established the Paris Nurseries. He was elected one of the first directors of the Fruit Growers' Association of Ontario and continued in office during the remainder of his life. He was an enthusiastic hybridist. Of his productions of grapes we note five varieties described in the Bushberg Catalogue for 1883, viz., Othello, Cornucopia, Autochon, Brant and Canada. In raspberries, he raised quite a number of crosses of Antwerp with a whitecap of high quality. Of his many apple seedlings, one especially has proved of standard value, viz., the Ontario, a cross of Spy with Wagener. In crossbred peas, he was very successful, one deserving especial notice, viz., Bliss American Wonder, a cross of Champion of England with Tom Thumb. For this he received from Messrs. Bliss & Son of New York, the handsome sum of $2,000. His death occurred in 1883. LINUS WOOLVERTON.

Avery, Robert, pioneer nurseryman, was born in 1796 and died December 30, 1879. He was the first nurseryman and orchardist in the state of Iowa, and in 1837 founded the largest nursery in the state. He himself planted and encouraged others to plant large numbers of fruit trees throughout the Mississippi Valley states.

Bancroft, George, the famous American historian (1800–1891), deserves remembrance among horticulturists for his notable collection of roses at his summer home in Newport, Rhode Island, an account of which may be found in the "American Garden," 1891. For a portrait and sketch, see "Appleton's Annual Cyclopedia" for 1890. In Bancroft's garden, George Field found a rose without a name, which is now known to be the French variety Mme. Ferdinand Jamin. It was introduced by Field & Brothers as the American Beauty.

Barry, Patrick (Fig. 1869), nurseryman, editor and author, was born near Belfast, Ireland, in May, 1816, and died in Rochester, New York, June 23, 1890. He came to America at the age of twenty, and after four years of service with the Princes, at Flushing, on Long Island, he founded in 1840, with George Ellwanger, at Rochester, New York, the Mount Hope Nurseries. Ellwanger and Barry introduced fruit-growing into western New York at a time when there were no collections of fruits, no railroad or telegraphic facilities, nor any fast ocean steamers to bring over their importations from Europe. From 1844 to 1852, Barry edited "The Genesee Farmer," an excellent and influential paper—afterward merged in "The Cultivator and Country Gentleman." After the death of A. J. Downing he succeeded to the editorship of "The Horticulturist," which he removed to Rochester, until June, 1855, after which this famous magazine had many vicissitudes until 1887, when it went to swell the number of periodicals now represented commercially by "American Gardening." In 1851 appeared his "Treatise on the Fruit-Garden," a new and thoroughly revised edition of which was issued in 1872, under the title of "Barry's Fruit-Garden." It is still one of our most popular books on pomology, and deservedly so. The catalogue of fruits which he compiled for the American Pomological Society is a monumental work. Mr. Barry did much to make Rochester a city of nurseries and western New York a famous fruit-growing region. The Western New York Horticultural Society, of which he was president for more than thirty years, and until his death, has long exercised a more than sectional influence. The work of Barry was truly national, and essentially that of a pioneer. He must be considered in the front rank of pomological authors, with the Downings, Warder, and Thomas, whose combined weight gave a great impulse toward establishing orcharding on a large scale in America. For a fuller account, see "Annals of Horticulture," 1890, 287–290.

WILHELM MILLER.

1869. Patrick Barry.

Bartram, John, called by Linnæus the greatest natural botanist in the world, was born at Marple, near Darby, Pennsylvania, March 23, 1699, and died September 22, 1777. He was a Quaker farmer, who became interested in botany after the age of twenty-four. In 1728, at Kingsessing, on the Schuykill River, he established the first botanic garden in America (page 348, Vol. I), which, together with his house, built in 1731 of stone hewn by his own hands, is preserved as part of the park system of Philadelphia (Fig. 1851). He traveled much in America, and was for many years the chief medium of exchange between Europe and America of plants of all kinds, especially new and important species, as *Rhododendron maximum* and *Cypripedium acaule*. His correspondence with Peter Collinson lasted nearly half a century. The letters, preserved to us in Darlington's "Memorials of John Bartram and Humphrey Marshall," are rich in botanical, historical and general interest. "Observations on the Inhabitants . . . made by John Bartram in his Travels from Pensilvania to Onondago, Oswego, and the Lake Ontario . . . London, 1751," is similarly readable, and a document of great value in the study of aboriginal races.

At the age of seventy he undertook, with his son William, an expedition to Florida, which is recorded in the "Journal Kept upon a Journey from St. Augustine up the River St. Johns." Bartram was probably the first American to perform successful experiments in hybridization. His sons, John and William, continued his garden. For many years it was the largest and best collection of trees and shrubs in America, and the services of the garden to early American horticulture were very great. He is commemorated in Bartramia, a genus of mosses, and in "Bartram's Oak," for the literature of which see I. C. Martinale's "Notes on the Bartram Oak, *Quercus heterophylla*, Michx.," published at Camden, New Jersey, 1880. Bartram's garden is a unique spot in America. Many of the trees have attained great age, size and beauty. The garden also contains many quaint and picturesque relics which have associations of great interest. On the whole, John Bartram is one of the most illustrious, and by far the most picturesque, of the early botanists and horticulturists of America, and his simple, wholesome, powerful personality presents a picture that is altogether amiable. New editions of the works of Bartram and Darlington are much to be desired, and offer a promising field to critical labors. John Bartram's son William is well known to students of American history for his "Observations on the Creek and Cherokee Indians, 1789." It is very much to be

regretted that no authentic portrait of John Bartram is known. For an excellent illustrated account of Bartram and his garden, see article by Miss M. L. Dock in "Garden and Forest," 9:121–124 (1895). See also "Harper's Magazine," 60:321–330 (1880). WILHELM MILLER.

Beadle, Delos W., scholar, horticulturist, writer, was the son of Dr. Beadle, St. Catharines, Ontario, one of the pioneer nurseryman of the province. He was graduated in Arts at Yale University in July, 1844, and two years later was granted B. A. (*ad cundem*) by the University of Toronto. In 1847, the degree of LL.B. was conferred upon him by Harvard University, and in 1848 he was called to the bar in New York City, where he practised law for about six years. In 1854, he was admitted to an interest in his father's business, and in this line he became widely known throughout Canada. In addition to his other business, Mr. Beadle accepted the position of horticultural editor of "The Canada Farmer," and in 1861, two years after its first organization in Hamilton, he was made secretary and treasurer of the Fruit Growers Association of Ontario, and himself contributed largely to its wonderful growth and usefulness, continuing to be its most important officer until his retirement in 1887. As a writer on horticultural and pomological subjects, Mr. Beadle occupies an important place, as shown by his numerous contributions to the reports of the above-mentioned society and to the "Canadian Horticulturist." Of this latter journal, he was practically the originator in 1878, and continued to edit it until 1887. In November, 1862, he was made corresponding member of the Entomological Society of Philadelphia, and in 1865 a corresponding member of the Horticultural Society of London, England. In 1872, Mr. Beadle published his "Fruit, Flower and Kitchen Gardener," and as late as the year 1903 contributed his final article to the "Canadian Horticulturist" entitled, "The Carnivorous Plants of Canada." He died in Toronto, Ontario, August 30, 1905. LINUS WOOLVERTON.

Berckmans, Prosper Julius (Fig. 1870), scholar, horticulturist, nurseryman, and botanist, was born in Arschot, Belgium, October 13, 1830, and died at Fruitland Nurseries, near Augusta, Georgia, November 8, 1910. His boyhood was spent upon the estates of his father, who was himself a horticulturist of some note. He secured his elementary education at Liers and Tourney; in 1845 he went to France, attending school at Saint Germain and graduating from Tours in 1847. While at Saint Germain, he took lectures on botany at the Jardin des Plantes in Paris, and whenever possible attended the meetings of the Royal Horticultural Society of France. In 1847 he returned to Belgium and spent three years overlooking the parental estates and studying botany at the Botanical Gardens of Brussels. It was during this period that he became acquainted with Bivort and other prominent European horticulturists.

For political and religious reasons, young Berckmans left Belgium for the United States in 1850; in 1851 he was joined by his family who soon thereafter purchased a farm near Plainfield, New Jersey. It was during his six years residence here that he first met Charles Downing and others prominent in American horticulture. In the fall of 1857, Mr. Berckmans moved to Augusta, Georgia, and established the Fruitland Nurseries by purchasing a one-half interest in the nurseries of D. Redmond. The following year, 1853, he bought the other half interest and started in business alone with about twenty-five acres of nursery stock. From that time until his retirement in 1907, Mr. Berckmans' sole object was the advancement and upbuilding of southern horticulture; and as a reward for his work the University of Georgia conferred the degree of Master of Science upon him in 1880.

Mr. Berckmans spent the major part of his life in an untiring effort to originate, introduce and disseminate fruits and ornamentals of value to the South. Plants, cuttings and seed were imported from all parts of the world to be tested at Fruitlands, and the nurseries became not only an experimental station but a botanical garden as well, from which disseminated many of the most valuable plants of the southern horticulturist, among which are the Honey and Peen-to peaches, Kelsey plum, Japanese persimmon, hardy lemon or *Citrus trifoliata* (Poncirus), Amoor River privet, *Biota aurea nana* (Thuja), besides other fruits and ornamentals.

1870. P. J. Berckmans.

The society affiliations of Mr. Berckmans were numerous and in their volumes of proceedings are found most of his writings. In 1869 he first took an active part in the Americal Pomological Society and served on various important committees until 1887 when he was elected president, which office he held until resigning in 1897. He founded the Georgia State Horticultural Society in 1876 and was its president from that time until his death in 1910. The Massachusetts Horticultural Society made him a corresponding member; he was likewise honored by La Societé D'Horticulture et D'Histoire Naturelle de L'Hérault de Montpellier, France; La Societé Pomologique de France, La Societé D'Horticulture de la Gironde de Bordeaux, and La Societé D'Horticulture du Department du Gard, France. His position as president of the State Horticultural Society of Georgia made him a member of the State Board of Entomology, on which board he served from its foundation until his death. He was also a member of the Board of Control of the Georgia Experiment Station when it was organized, but served only a few years. In 1883–4 he went to Europe for the United States Government, to collect horticultural exhibits for the New Orleans Exposition. He was presiding officer over the Horticultural Congress in Chicago in 1893; Chairman of the Jury of Award at the Jamestown Exposition in 1907; and the only American representative to judge the fruit at the centennial of La Royale Societé d'Agriculture et de Botanique de Gand, at Ghent, in 1908. T. H. MCHATTON.

Brackett, George C., nurseryman, was born at Unity, Maine, October 26, 1830, and died at Fresno, California, April 18, 1903. In his early years, his family moved to Cincinnati, Ohio, and later to Denmark, Iowa, where his father commenced the nursery business. It was here that George became interested in horticulture. He was a graduate of Amherst College. In 1856, he went to Leavenworth, Kansas, and joined the army. He was in a law partnership from 1857 to 1859 and, after the dissolving of this partnership, he bought land near Leavenworth and opened up a nursery and fruit farm. This was the first nursery established in Kansas. Mr. Brackett was the first to introduce the cultivation of the strawberry and the first to grow pears in Douglas County. He was a charter member of the Kansas State Horticultural Society and its secretary for twenty-six years; also secretary of the American Pomological Society 1891 to 1898. For portrait, see "Trans. Kansas Horticultural Society," Vol. XXVII, p. 8.

Breck, Joseph, 1794–1873 (Fig. 1871), Boston seedsman, and author of "The Flower Garden, or Breck's Book of Flowers," first published in 1851, and reissued in 1866 as the "New Book of Flowers." This was preceded, in 1833, by "The Young Florist." In 1822, he founded the seed business now conducted at 51 North Market Street, under the name of Joseph Breck & Sons. He was one of the original members of the Massachusetts Horticultural Society, and its president from 1859 to 1862. He edited the old "New England Farmer" for many years, but discontinued it in 1846, when he turned over his list of subscribers to Luther Tucker, of Albany, New York, at the time of the founding of "The Horticulturist," which was edited by the illustrious A. J. Downing. He also edited "The Horticultural Register" from 1836 to 1838, in company with Thomas Fessenden. The revision of his book in 1866 was undertaken when the author was seventy years old. It was a popular book in its day. WILHELM MILLER.

Bridgeman, Thomas (Fig. 1872), gardener, florist, seedsman and author, was born in Berkshire, England, and came to America in 1824, and established the business which is now conducted under the name of his son, Alfred Bridgeman, at 37 East Nineteenth Street, New York. An historical account of this business may be found in the catalogue of the present firm. In 1829, Thomas Bridgeman published "The Young Gardener's Assistant," which was many times reprinted and eventually enlarged to five times its original bulk. It was copyrighted in 1847, when it appeared as a large-sized work in three parts, covering fruit, vegetable, and ornamental gardening. Two of these parts were published separately in the same year as "The Kitchen Gardener's Instructor," and "The Florist's Guide." The first-named work was revised by Sereno Edwards Todd, and republished in 1866 by Alfred Bridgeman. Thomas Bridgeman died in 1850. WILHELM MILLER.

1871. Joseph Breck.

1872. Thomas Bridgeman.

1873. William Brincklé.

Brincklé, William Draper (Fig. 1873), physician and amateur pomologist, was born in Delaware. He began the practice of medicine at Wilmington in 1820, moved to Philadelphia in 1825, where he passed most of his life as a busy physician, and died at Groveville, New Jersey, in 1863, at the age of sixty-four. In a room of his Philadelphia home he hybridized strawberries, and had fruit at every season of the year. He also had a little garden about the size of a parlor. He produced the Cushing strawberry, the Wilder, President Cope, Cushing, and Orange raspberries, and the Wilmington and Catherine Gardette pears. Unfortunately, most of his work with raspberries was done with *Rubus Idæus*, the Old World species, which is not hardy in America, but his yellow-fruited variety of raspberry is still regarded by many as the acme of quality. He was for many years vice-president of the Pennsylvania Horticultural Society, and was regarded as a leader of American pomology. In raising pear seedlings, he was wont to graft and regraft annually, after the second or third year from seed. He thus produced new fruits in half the time required by Van Mons, many of whose novelties did not fruit within twenty years from seed. Dr. Brincklé gave away thousands of grafts to amateurs and tradesmen everywhere, and always prepaid the carriage. In 1860 he edited "Hoffy's North American Pomologist," a high-class periodical with colored plates, which, unfortunately, did not survive. Some sprightly anecdotes of Dr. Brincklé are reprinted from the "Gardener's Monthly" for 1863, in Bailey's "Evolution of Our Native Fruits." WILHELM MILLER.

Brown, Jacob G., pomologist, was born in Lewisburg, Pennsylvania, April 26, 1825, and died near Wyoming, Delaware, November 17, 1896. He came to Delaware in March, 1868, and purchased a farm of about 200 acres in central Kent County. He immediately planted a peach orchard of 2,700 trees. In 1870 he set another peach orchard and 200 apple trees. In 1872 he set about 20 acres in apples, another 20 acres in peaches, and commenced growing small-fruits, especially red raspberries, increasing until he had 50 acres of red raspberries, and in 1885 nearly the whole farm of 200 acres was set in fruit, 100 acres of it in apples. He planted nearly every variety of apples that he could find described in the catalogues of nurserymen. Mr. Brown made a close study of fruit-growing and carried on the business with a great deal of energy. He became a member of the Peninsula Horticultural Society soon after its organization in 1888, and took great delight in talking about his fruit-growing. He was especially enthusiastic about apple-culture. He was one of the pioneers in apple-growing in Delaware and became more sanguine of its great success year by year until his death in 1896. Mr. Brown took an active interest in every movement that was planned to develop fruit-growing, and was a public-spirited citizen.

WESLEY WEBB.

Bruner, Thomas Kincaid, was born in Salisbury, North Carolina, on January 17, 1855, and died in Raleigh in February, 1908. For many years his father was editor and owner of the "Salisbury Watchman." Young Bruner, who received his education at Finley's Aca-

demic School in Lenoir, North Carolina, early entered his father's office. His intelligence, industry, and initiative united to induce him to study nature and nature's works, along with his daily duties, and led him to be a reader and a thinker. In 1886 he was selected as secretary of the State Board of Agriculture, and thereafter he lived in Raleigh. His services as secretary were varied. He had devoted especial attention to the study of geology, crystalography, and arboriculture. In his new field he collected for the state and for various expositions specimens of ores, crystals, woods and other natural products that attracted attention wherever they were displayed. He was in charge of the state exhibits at Atlanta, Georgia, at Boston, at Omaha, at Chicago, at St. Louis, and in Paris. He was a member of the International Jury of Awards at New Orleans as representative for the Bulgarian government. He edited and wrote many articles on the resources of his native state. Mr. Bruner's interests were wide and his mental activities covered many subjects. Few men ever rendered more service to the agricultural and industrial life of their states. D. H. HILL.

Bryant, Arthur, pioneer nurseryman of Illinois, was born near Princeton, Illinois, on October 15, 1834, and died May 13, 1907. Early in life, he became interested in the nursery business as an aid to his father and later as owner of the business. Mr. Bryant was one of the founders of the Northwestern Fruit Growers' Association and at one time its president. He was also president of the Illinois State Horticultural Society and of the Northern Illinois Horticultural Society for a time.

Budd, Joseph Lancaster, horticulturist, investigator and educator, was born near Peekskill, New York, July 3, 1835 and died at Phœnix, Arizona, December 20, 1904. In 1859, he started in the nursery business at Wheaton, Illinois, and a few years later removed to Shellsburg, Iowa, where he established the Benton County Nurseries. He was successful as a nurseryman and fruit-grower, but in 1876, he accepted the professorship of horticulture and forestry at the Iowa Agricultural College where he remained for nearly twenty-two years. Professor Budd was instrumental in the importation of hardy trees, shrubs and fruits from Europe, especially from Russia, which he visited in 1882, with Charles Gibb, for this purpose. He also improved many native fruits, foremost amongst which was the plum. Professor Budd was the author of the "American Horticultural Manual." For a fuller account and portrait, see "Cyclopedia of American Agriculture," Vol. IV, p. 558.

Buist, Robert, florist, seedsman, and author, was born at Cupar Fyfe, near Edinburgh, Scotland, November 14, 1805, and died in Philadelphia, July 13, 1880. He was trained at the Edinburgh Botanic Gardens, came to America in August, 1828, and was employed for a time by Henry Pratt. In 1830 he became the partner of Hibbert, who had established the first notable florist's business in Philadelphia. He became noted for his successes with roses, which were at that time second in popular favor to the camellia with the Philadelphians. The great improvement of the verbena was largely due to him, and was immediately followed by the introduction into America of a distinct class of bedding plants. He introduced *Poinsettia pulcherrima* to the trade, and his sale of the double form is said to have been the first transaction of the kind accomplished by ocean telegraph. He was the author of "The American Flower-Garden Directory," in 1832, "The Rose Manual," 1844, and "The Family Kitchen-Gardener" (copyrighted, 1847), all of which were frequently reissued, and enjoyed a considerable sale for many years. An excellent account of his life may be found in "The Gardener's Monthly," 22:372 (1888). The frontispiece of the bound volume for the year is his portrait. WILHELM MILLER.

Bull, Ephraim W., the introducer of the Concord grape, lived a long, quiet, and useful life in Concord, Massachusetts, where he died September 27, 1895, in his ninetieth year. In commercial importance, the greatest event in the early history of American grapes was the introduction, early in the fifties, of this variety of the northern fox-grape. The first fruit of this grape was obtained in 1849. Its exact origin is obscure. In 1840, Mr. Bull bought the house in which he lived until his death. That year some boys brought from the river some wild grapes, and scattered them about the place. A seedling appeared from which Mr. Bull obtained a bunch of fruits in 1843. He planted seeds of this bunch, and a resulting plant fruited in 1849. This variety was named the Concord. It soon became the dominant grape in all eastern America, as it was the first variety of sufficient hardiness to carry the culture of the vine into every garden in the land. It is a pregnant type, and has given rise to no less than fifty honorable seedlings, which range in color from greenish white to purple-black. The quality of the fruit is excelled by many varieties, but the latter usually demand more careful cultivation. The Concord is the one most important type of American grape, and the really successful commercial viticulture of the country dates from its dissemination; and yet this grape is apparently only twice removed from the wild vine. (See Fig. 1709.) For portrait, see Bailey, "Evolution Native Fruits."

Ephraim W. Bull was loved of his neighbors and honored by every countryman who grows or eats a grape. He made very little money from his variety, and died in extreme poverty. The original vine is still preserved, as a sprout from the old root. L. H. B.

Burnet, Robert, minister and horticulturist, was born at Lady Kirk, Berwickshire, Scotland, 1823; died at Hamilton, Ontario, 1889. After his ordination, he volunteered as a missionary to Ontario, then Upper Canada. For twenty-six years, he was minister to St. Andrew's church, Hamilton, Ontario, during which time he took a very active interest in horticulture. His large garden was to him both a pleasure and a study and contained a very large and choice collection of varieties of dwarf pears and other fruits. From these, he gained many valuable notes for use at meetings of the provincial fruit growers' association. In the year 1869, Mr. Burnet was elected president of this association, an office which he filled with great credit for ten successive years. His annual addresses formed an important feature in the annual reports made to the Department of Agriculture for Ontario during those years. The reports also contain several prize essays by him, as for example in 1875 one on "The Cultivation of the Pear," and one on "Where and How to Market our Fruits;" also in 1876 an excellent paper entitled "Criteria for Fruit Judging."

LINUS WOOLVERTON.

Burr, Fearing, seedsman and author, was born in 1815 and died suddenly at his home in Boston, Massachusetts, October 4, 1897. He gained his horticultural experience in early life on the broad acres of the paternal homestead. This experience, added to his inherent tastes and his copartnership in the firm M. &. F. Burr, Seedsmen, Boston, gave him creditable notice as a prominent horticulturist throughout New England and the distant states and territories. His firm was among the early ones which exchanged international courtesies with seedsmen. In 1865 he published "The Field and Garden Vegetables of America." This was a very interesting and erudite contribution to horticulture at that day, and the book found ready sale. He was an author of some note and contributed to the horticultural columns of the press. He was elected a

life member of the Massachusetts Horticultural Society in 1852 and did much excellent work for the society in the matter of judging fruits and vegetables, and making creditable exhibits. In 1857 his firm was awarded a silver medal for its display of "Sixty Varieties of Beans, all neatly and correctly labelled." He was diligent in business, a fluent conversationalist, a ready writer, an earnest lecturer and a man whose judgment and advice on horticultural topics was earnestly sought.

G. B. BRACKETT.

Bush, Isador, nurseryman and pioneer grape-grower, was born in 1822 at Prague, Bohemia. He died in the city of St. Louis, Missouri, August 5, 1898, having been a resident there for more than fifty years. In 1865, he established a grape nursery at the place he named Bushburg, Missouri, and devoted himself to the cultivation of this specialty with marked enthusiasm and success. He soon had a collection of all known species and varieties of our native grapes and with the assistance of the eminent botanist, George Engelmann, a very complete classification of various species was made and their characteristics were fully described in his valuable publication, the "Bushburg Catalogue and Grape Manual." It was through the enterprise of Mr. Bush that our immune grape roots were sent to Europe for the purpose of grafting the vinifera varieties upon them, and thus the ravages of phylloxera were prevented. The American grape industry owes a debt of lasting gratitude to the pioneer work of Mr. Bush.

G. B. BRACKETT.

Butz, George C., horticulturist and educator, was born at New Castle, Pennsylvania, on February 1, 1863, of Swiss parentage, and died December 14, 1907. He was prepared for college at the New Castle High School and graduated from Pennsylvania State College in 1883. The following year he became an instructor in the preparatory department of the college; in 1887 he was elected to the position of assistant professor of horticulture, and in 1903 he was made professor of horticulture. During many years, he was also a lecturer at the farmers' institutes of the state, nursery inspector and adviser for the State Department of Agriculture, and horticulturist of the State Experiment Station. He is the author of a number of valuable bulletins and other publications upon subjects relating to his life work. A natural love for plants from his boyhood made Professor Butz an apt pupil and determined his life work. He was an authority on horticultural subjects. His opinion on the culture of grapes, peaches, ginseng and carnations was much sought after by state authorities, and his writings upon these subjects were highly valued.

Intellectually Professor Butz was a man of culture and broad horizon. His mental operations were painstaking, methodical, exact. Notwithstanding his lifelong practical experience in horticulture, he was a careful student of its rapidly developing literature and brought to his work the combined products of observation and wide reading. Always devoted to duty, cheerfully making the best of adverse conditions, spending himself unstintedly for the welfare of his college and of his state, his life of high ideals and unselfish service was an inspiration to all who knew him. R. L. WATTS.

Campbell, George Washington, horticulturist, was born in Cortland County, New York, January 12, 1817, and died at Delaware, Ohio, August, 1898. He is best known as the introducer of the Delaware grape. He originated and improved numerous other varieties of grapes, among which are Campbell's Early and Lady. For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 560.

Carman, Elbert S. (Fig. 1874), agricultural editor and experimenter, was born on Long Island in 1836 and died in 1901. He was educated at Brown University and after graduating was in business for a number of years. Always interested in gardening and fruit-growing, he finally associated with the late Andrew S. Fuller in conducting the "Rural New Yorker." A little later Mr. Carman bought the paper and established in connection with it the Rural Experiment Grounds in New Jersey. Here he tested with great care the varieties of farm and garden seeds offered by seedsmen. At that time, the ordinary seed catalogue was filled with gross exaggeration in text and illustration. Mr. Carman's accurate reports were largely instrumental in starting a genuine reform in catalogue-making. Later he spent much time at hybridizing and selecting new varieties of potatoes, grains and flowers. His most notable achievement in this line was the famous family of Carman potatoes, including the Rural New Yorker No. 2. At one time, it is probable that there were more of this variety grown than of any other known sort. In the markets today, the larger number of round, thick potatoes are known and sold as "Rurals." As a farm journalist, Mr. Carman was very successful, giving power and individual character to his paper. He wrote one book "The New Potato Culture" in which he recorded his exhaustive experiments with fertilizers, preparation of seed and methods of culture.

1874. Elbert S. Carman.

H. W. COLLINGWOOD.

Carr, Robert, was born in the parish of St. Andrews, County of Downs, in the north of Ireland, in 1767. He was but eight years old when he was brought to Philadelphia. In later years, William Bartram, proprietor of the celebrated Bartram Gardens became his friend, and later his father-in-law. At the death of Mr. Bartram, Mr. Carr continued the business of the Gardens, which were the cradle of botany and horticulture on the American continent. The Gardens gave these sciences a distinguished position in the literature of the old world, and they were also the pride of every Philadelphian for a great many years. At the formation of the first society of horticulture in 1827, Colonel Carr was a charter member, and in 1834 he was made its vice-president, a position he held until the time of his death, which occurred in 1866. G. B. BRACKETT.

Cobbett, William (1762–1835), the once-famous English author, had two periods of enforced residence in America, and wrote "The American Gardener," which is one of the spiciest books in the whole history of American horticulture. He was of thorough Saxon ancestry, and while a gardener's lad and during eight years of military service, made strenuous efforts at self-education. In 1792 his personal liberty was endangered by the publication of "The Soldier's Friend" (an appeal for an increase of pay), and he came to Philadelphia in the autumn of that year. His first success was a pamphlet entitled, "Observations on Dr. Priestly's Emigration," a bitter attack on the French Revolution. He took the loyalist side in American politics, and is regarded as the founder of the American party press. His attack on Benjamin Rush, the leading physician of Philadelphia, for his advocacy of unlimited

bleeding for yellow-fever, resulted in a libel suit, and damages of $5,000, which nearly ruined Cobbett, and sent him to England in June, 1800. In 1802 he began "Cobbett's Weekly Political Register," which he edited for thirty-three years, and until his death, except during an interval of imprisonment and a second withdrawal to America. His real work was domestic reform, and the circulation and influence of his journal were immense. He wrote extensively and entertainingly on a wide variety of subjects. As historical documents, his works are indispensable.

Cobbett's horticultural writings of chief interest to us are "Cottage Economy," "A Year's Residence in the United States of America," and, most of all "The American Gardener" (1821), which was reproduced with considerable modifications as "The English Gardener," in London, 1827. The American edition of Wm. Forsyth's excellent "Treatise on the Culture and Management of Fruit Trees," was published at New York and Philadelphia in 1802, and in Albany in 1803, and was one of the most influential books on fruit-growing in the period before orcharding over large areas gave rise to essentially American horticultural writings.

WILHELM MILLER.

Cole, Samuel W., nurseryman, author and editor, was born in the town of Cornish, Maine, in 1796, and died at Chelsea, Massachusetts, December 3, 1851. At about the age of twenty he left his native state and passed two or three years in New Jersey and Pennsylvania in teaching. Soon after his return he published the "Columbian Spelling Book," a collection of poems called "The Muse," and in 1835, the "Yankee Farmer;" the latter he removed to Portland, Maine, and continued there about three years, in connection with a seedstore and agricultural warehouse. In 1839 he came to Boston and continued connected with the agricultural press to the time of his death and was editor of the "New England Farmer" during the years 1849, 1850 and 1851. Mr. Cole published the "American Fruit Book" in 1849, and a book on "Diseases of Domestic Animals," which have passed through several editions. He also established and carried on the Winnisimmet Nurseries in Chelsea, Massachusetts, during the years from 1840 to 1850.

WM. P. RICH.

Coleman, Norman J., lawyer, agricultural journalist, first Secretary of Agriculture, and horticulturist, was born near Richfield Springs, New York, May 16, 1827, and died in St. Louis, Missouri, November 3, 1911. He was granted the degree of Bachelor of Law from the University of Louisville (Kentucky), and for some years was a practising attorney at New Albany, Indiana, and later in St. Louis. With an intense love of rural pursuits, he gave up his lucrative law practice, purchased a country home near St. Louis, and began the publication of "The Missouri Valley Farmer," now known as "Coleman's Rural World," one of the pioneer agricultural papers of the Mississippi Valley. He was Lieutenant-Governor of Missouri, 1874 to 1878; served as a member of the Board of Curators of the Missouri State University for sixteen years and was, for a number of years, a member of the Missouri State Board of Agriculture. He was Secretary of Agriculture during the administration of President Cleveland, being the first to hold this position after its creation as a cabinet office. Through the "Rural World" he issued a call for "a meeting for the purpose of advancing and directing the fruit-growing interests of Missouri and the West." As a result, on January 5, 1859, "The Missouri Fruit Growers' Association," since 1868 known as the "Missouri State Horticultural Society," was organized. Mr. Coleman was the first president of this organization and served in this capacity for periods aggregating nearly a decade. This is the oldest, permanent fruit-growers' organization west of the Mississippi and its annual reports, covering a period of more than half a century, are an important adjunct to the literature of the horticultural development of the section. In his official positions, Mr. Coleman's energies were largely devoted to the organization of horticultural interests. His horticultural writings occur mainly in the Reports of the Missouri State Horticultural Society and in the columns of "The Rural World."

J. C. WHITTEN.

Conard, Alfred Fellenberg, nurseryman and original president of The Conard & Jones Co., of West Grove, Pennsylvania, was born in Philadelphia, in 1835, and died December 15, 1906. He was descended from German Quakers, who joined William Penn's Colony in 1683. His early life was spent on his father's farm near West Grove, where later he learned the nursery business under the personal supervision of Thomas M. Harvey. Soon after 1862, with Charles Dingee, he established a nursery business under the firm name of Dingee & Conard. This prospered, and about 1869, the firm turned its attention to the propagation of roses by a new process introduced by Antoine Wintzer, an expert Alsatian propagator. This was a success so far as the production of roses was concerned, but the wholesale demand at that time was small and the problem soon presented itself of how to market their rapidly increasing stock. With rare foresight Mr. Conard conceived the idea of disposing of it at retail through the mails.

The company issued at first a very modest catalogue. It was skilfully prepared, and offered bedding plants, shrubbery, bulbs, seeds, and the like, in addition to their attractive list of roses. This, accompanied by wise advertising, brought in orders quite satisfactorily, and strictly fair and honorable treatment of customers, good healthy stock and careful packing soon established for the company an enviable reputation, and their trade extended to all parts of the world.

About the year 1892, Mr. Conard and Mr. Wintzer having previously become separated from the Dingee & Conard Co., associated themselves with S. Morris Jones, and organized the Conard & Jones Co., for the purpose of continuing the growing and distribution of roses, flowering plants, and the like. As a specialty, they took up the improvement of the canna.

Mr. Conard was a man of very retiring nature, and for this reason was not so prominent in the trade generally as his long experience and extensive knowledge of the floral business would have warranted. He was scholarly in his tastes, methodical and precise in his habits, well read and well informed. He was particularly proficient as a mail-order salesman, and was the first advertiser in any line of business to contract with advertising concerns to place the business on a percentage basis, a plan that has now been almost universally adopted.

THOMAS P. CONARD.

Coxe, William, pioneer pomologist, was born in Philadelphia, May 3, 1762, and died on his farm on the Delaware River near Burlington, February 25, 1831. He deserves special remembrance for his excellent and now scarce book, "A View of the Cultivation of Fruit Trees, and the Management of Orchards and Cider," with accurate descriptions of the most estimable varieties of native and foreign apples, pears, peaches, plums and cherries cultivated in the Middle States of America. This was printed at Burlington, and published at Philadelphia in 1817. Grapes and small-fruits were not included in the scope of his book, but an article of his in the "American Farmer" for July, 1828, shows that he was acquainted with many varieties of grapes, and had done much grafting. His book was a standard until the time of the Downings, and was freely used by other authors. The illustrations were excellent for their time, but show only the size and outline of a fruit, and whether it was dotted, splashed or streaked. (Fig. 1858.)

Coxe said, 1817, that he had been "for many years actively engaged in the rearing, planting and cultivating fruit trees on a scale more extensive than has been attempted by any other individual of this country." He also had a national reputation for his cider at an age when it was a famous and characteristic beverage.

William Coxe belonged to one of the most refined families of Philadelphia. His early education was somewhat meager by reason of the Revolutionary War, but he became a cultured gentleman. John Jay Smith gives this pleasant picture of him: "Well do we remember his extensive library in his fine mansion on the 'Bank' at Burlington, when as a little boy we were assigned the duty of bringing away, or taking home, some book or pamphlet from his ever open stores of information. . . His person was handsome, and his bearing that of the 'old-fashioned' gentleman, improved by mixing in the best society, but retaining the forms of the greatest politeness and suavity, that modern usages are too rapidly casting off. An errand to Mr. Coxe's was a cherished privilege; never was the opportunity neglected by him to place in the hand of his visitor some fruit that he so well knew would be appreciated by a youthful appetite. The finest Seckel pears we have ever seen were not unfrequent deposits. He had an especial fondness for the Seckel pear, which is certainly among the half-dozen most famous pears of American origin, and which was pronounced by Downing to be the finest flavored of all pears." Coxe was made an honorary member of the Horticultural Society of London for making known the merits of this pear through Dr. Hosack. Either the first willow or the first poplar planted in Burlington is said to have been brought from Halifax in the hand of William Coxe. He planted many trees to beautify the town and, in particular, extended the front of the "Green Bank." Biographical details are unfortunately only too meager. A few other details may be gleaned from the "Horticulturist," 11:304–307 (1856). WILHELM MILLER.

Craig, John (Fig. 1875), horticulturist and educator, was born at Lakefield, Argenteuil County, Quebec, in 1864, and died at Siasconsett, August 10, 1912. He obtained his early education at Montreal High School and McGill College. Early in life he exhibited a taste for horticulture and later studied under one of the greatest pioneer horticultural teachers, J. L. Budd, of the Iowa Agricultural College. Shortly after graduation from this institution in 1887, Professor Craig was appointed horticulturist at the Central Experimental Farm at Ottawa. He was called to Iowa as professor of horticulture in 1899, and in 1900 became professor of extension teaching at Cornell University. In 1903, he was appointed professor of horticulture at this institution, which position he held until his death. During the latter years of his life, Professor Craig took great interest in the development of nut-culture, both for the North and South, and was the recognized authority on many kinds of nuts. He contributed largely to horticultural and agricultural magazines and was the editor of "The National Nurseryman" for several years. Professor Craig was a member of the advisory board of the American Civic League, and chairman of the nomenclature committees of the American Sweet Pea and the American Peony Societies. He was also elected a fellow of the Royal Horticultural Society of Great Britain. He was well known for his interest and work as a pomologist, having been early associated with Charles Gibb (p. 1576), and having followed the subject closely throughout life. In 1903, he was elected secretary of the American Pomological Society, which important position he held until his death. A. C. BEAL.

1875. John Craig.

Curtis, Joseph, pioneer fruit-grower of Illinois, was born in New Jersey, May 29, 1786, and removed with his parents when a boy, to Manchester, Ohio. He had never seen a nursery and had no horticultural experience, but he invented the arts of root-grafting and collar-grafting fruit trees through stern necessity for grafting stock. At the age of sixteen he had secured a piece of land on which to plant an orchard. He had grown some seedling trees but had an insufficient number for the ground he had. As the pieces of roots were plowed up, it occurred to him that he might make more trees by grafting these roots. He succeeded and immediately thereafter invented collar-grafting. He was from 1798 to 1817 collecting and testing twenty-seven varieties of apples in his Ohio orchard. In March, 1818, he built a log-cabin, selected a fine tract of land in what is known as the north arm of Grand Prairie, Edgar County, Illinois, and in 1818 established the first nursery in the state of Illinois and the first orchard of grafted fruit trees planted in Edgar County. He grew such varieties as Yellow Newtown, Smith (Cider), Newtown Spitzenberg, Milam, Priestley, Gilliflower, Rhode Island Greening, Rambo and Winesap. He originated a number of choice varieties of fruits, especially some of our leading varieties of apples. He did more than any other one man of his day to introduce choice fruits into southern Illinois and the adjacent territories. Among his most zealous contemporaries were Edson Harkness of Tivoli, Peoria County, Cyrus Overman, Canton, and Arthur Bryant, Princeton. To such men are due the credit of the organization of the Northwestern Fruit Growers Association in 1851, the first society of its kind west of the Alleghanies, embracing great extent of territory and demanding any great degree of public opinion. And through the united efforts of these men, with others, the Illinois Horticultural Society was organized at Decatur in 1856. G. B. BRACKETT.

Darlington, E. Dillwyn, was born on November 20, 1858, in Doylestown, Pennsylvania, and died March 26, 1908. As a boy he entered a small private school, later the Doylestown Seminary, and finally Swarthmore College at the age of sixteen. Intensive study up to this time had undermined his health to such an extent that after a few months he was obliged to leave school. An inborn desire for activity prompted him to seek and find a position in the office of the Doylestown "Intelligencer." But even this proved too confining so that, after a few weeks, he had to give up and seek occupation outdoors. A natural tendency started him growing plants for local markets. Soon he found out how much had to be learned in this line and he secured a position with the prominent firm of Hoopes, Bro. & Thomas, Nurserymen, of West Chester, Pennsylvania. After serving an apprenticeship of one year, he returned to Doylestown to start seriously in the business of growing plants for sale. This was in 1875. Steadily he grew and developed until in 1883 he became connected with what turned out to be his life's work—the trial-grounds of W. Atlee Burpee & Co., Seedsmen, Philadelphia. Mr. Darlington first conducted these trials on a vacant lot adjoining his property. As the Burpee business grew, the trial-grounds grew, and when, in 1888, a farm was acquired for the purpose of doing this important work, Mr. Darlington logically became superintendent of the new venture.

From that time until his death he served the American public with a keen, observing and analytical mind possessed by few men. For twenty-five years he studied the merits and faults of all sorts of vegetables and flowers. Tens of thousands of trials came under his observation every year. The best of European and American seed-breeders' efforts had to pass his critical decisions, and out of this tremendous "sifting" process rose scores of meritorious varieties of vegetables and flowers, the names of which have since become household words with planters throughout the country.

ADOLPH KRUHM.

Dartt, Edward Harvey Schuler, nurseryman, was born at Weathersfield, Vermont, November 24, 1824, and died at Owatonna, Minnesota, January 31, 1903. At the age of twenty, he moved from Vermont to Ripon, Wisconsin, where he attended college and taught school. About 1860 he moved to Kingston, Wisconsin, and engaged in general merchandising, holding at the same time the offices of postmaster and justice of the peace. In 1869 he removed to Owatonna, Minnesota, where he remained until his death. He engaged at once in the nursery business and continued in it more or less the rest of his life. He was one of the early members of the State Horticultural Society, and in 1889 was made an honorary life member for conspicuous efforts along horticultural lines.

In 1891 the Owatonna Tree Station was established by act of the legislature and Mr. Dartt was made its superintendent and continued in this capacity until his death. He conducted many experiments here and raised thousands of seedlings, contributing much to the horticultural knowledge of the state by his efforts. He was always active in the meetings of the society and much of the early advancement in horticulture in Minnesota is due to Mr. Dartt. He laid out and maintained a public park at his own expense for many years and was always interested in civic improvements in the town. He delighted to write short articles on civic and horticultural affairs for the press and in this way helped to mold public opinion. LE ROY CADY.

Deane, Rev. Samuel, poet and agricultural writer, was born at Dedham, Massachusetts, July 30, 1733, and died at Falmouth (now Portland), Maine, November 12, 1814, where he had been pastor since October 17, 1764. While vice-president of Bowdoin College, he published, in 1790, his "New England Farmer, or Georgical Dictionary," the first American encyclopedic work on agriculture. This had a much wider circulation, probably, than Jared Eliot's "Essays upon Field-Husbandry," 1747. Its influence may be traced to the middle of the present century. Deane's work was freely quoted by F. G. Fessenden until his death, in 1837. The second edition, 1797, was entitled "The Georgical Dictionary." A third edition was published in 1822.

Deane and Eliot were the chief writers in that early stage of American horticulture when it was hardly important enough to be considered distinct from general agriculture. For biographical details, see Drake's "Dictionary of American Biography."

Dearborn, Henry Alexander Scammell, soldier, statesman and author (1783–1851), was also an ardent horticulturist. He was a moving spirit in the organization of the Massachusetts Horticultural Society, and was elected its first president March 17, 1829. He was partly instrumental in the establishment of an "experimental garden and cemetery at Mount Auburn," the parent of rural cemeteries. The plan of the cemetery was largely his. He "devoted himself to this work most assiduously," writes the chronicler of the society, "spending the greater part of the autumn [1831] at Mount Auburn, in laboring with hands as well as mind, without money and without price." The Abbé Berlese's "Monography of the Camellia" was translated by him, and published in Boston in 1838. He also translated from the French, in 1830, an account of the since famous *Morus multicaulis*. He left MS. writings on horticulture. For notes on his horticultural labors, see "History of the Massachusetts Horticultural Society," 1880, which contains a portrait; also John B. Russel in Tilton's "Journal of Horticulture," 7:88, 157, 276. Gen. H. A. S. Dearborn was son of Gen. Henry Dearborn, of Revolutionary and later fame. L. H. B.

Dempsey, Peter C., pomologist and hybridist, was of United Empire Loyalist stock and was heir to the orchard and nursery left by his father at Albury, Prince Edward County, Ontario. About the year 1867, Mr. Dempsey decided that he would devote his life to horticulture, and especially to the cultivation of the apple. In 1859, he united with the Fruit Growers' Association of Ontario and being a pleasing and fluent speaker, full of information drawn from practical experience, he soon became a highly valued member and was elected vice-president in 1873 and again in 1875; and president in 1880 and again in 1881. In 1775, he was selected by the Ontario Department of Agriculture to superintend the Ontario fruit-exhibit at the Centennial exhibition in Philadelphia, and secured several medals for its excellence. But it is as a hybridist that Mr. Dempsey is most widely known among horticulturists, having originated among other novelties the Burnet grape, the Dempsey potato and the Trenton apple. His death occurred in August, 1892, at Albury.

LINUS WOOLVERTON.

Dixon, John N., pomologist, was born in Fayette County, Pennsylvania, on February 20, 1821, and died in 1883. When quite young, his parents moved to Ohio, and here at the age of twenty-two, he set out an orchard of 1,100 trees, a large orchard for those days. In 1855 he went to Iowa, expecting to make fruit-growing his specialty, but on account of the cold winters and tender varieties, lost most of his trees. He persisted, however, and in 1868 started the present orchard of 12,000 acres, of which he made a great success. He is said to have been the first man to use insecticides in the form of spray in a commercial way in fruit plantations.

Dorner, Frederick, florist, was born at Schilltach, Baden, Germany, on November 29, 1837. At the age of seventeen he emigrated to this country and joined his brother at Lafayette, Indiana, where he lived until his death, December 29, 1910. In 1870, after being employed at various occupations, he rented a small farm and became a market-gardener. In the small greenhouse on the place, he began raising potted plants for the retail market. In 1888 he became interested in some experiments in the breeding of carnations, which were being conducted at Purdue University. He quickly saw the possibilities of the work and became so deeply interested that he took up this line of work himself. From the first lot of seedlings, raised in 1889 and numbering about 500, came the varieties Christina Dorner, Tecumseh, Hoosier, Mrs. Harrison, Indiana, and Ben Hur. His work continued uninterruptedly for twenty-one years and during this time he grew over 150,000 seedlings. Of this number not more than seventy-five ever reached the market. Among the best of his productions were Mad. Diaz Albertini, Wm. Scott, Mrs. G. M. Bradt, White Cloud, Lady Bountiful, White Perfection, Pink Delight, and White Wonder. Fred Dorner was the first florist in the Middle West to disbud carnations. The method of supporting carnations by means of wires and cross strings also originated with him. His work, however, was not limited to carnations. He was also the originator of a number of good chrysanthemums of which Major Bonnaffon, disseminated in 1894, was the best. H. B. DORNER.

Douglas, Robert (Fig. 1876), pioneer nurseryman in Illinois, was born at Gateshead, England, in 1813. He came to America in 1836, finally settling at Waukegan, Illinois, in 1844. Here he founded a small nursery where he raised conifer and other tree seedlings. This was the first attempt ever made in America to raise evergreen trees commercially. Through his efforts, many successful plantations of forest trees were established on the western prairies. He has been called "the apostle of tree-planting in the West." Mr. Douglas was also a good botanist and an authority on evergreens. He was an active member of the Illinois State Horticultural Society. He died in 1897.

1876. Robert Douglas.

Douglas, Thomas Henry, nurseryman and forester, was born at Waukegan, Illinois, July 31, 1852, and died March 26, 1907. After completing his education at Racine College, he engaged in the nursery business with his father, the late Robert Douglas, whose early experiments and later his success in growing conifers from seed gave him a national reputation. Inheriting the natural qualities of a forester from his father and being a close student of nature, he soon acquired a wide knowledge of forestry which was recognized in 1886 when he was called to the State Board of Forestry of California as Head Forester and soon after was called to a similar position at Leland Stanford, Jr., University. While there he collected many plants then new to California, tested them out and introduced them. In 1892 he visited the home of the weeping spruce (*Picea Breweriana*) on the summit of the Siskiyou Mountains and succeeded in gathering the first seed and raising the first seedlings of this species. He cared little for publicity but was freely consulted on all matters pertaining to forestry, and his articles on this subject are considered an authority. Many of his introductions, notably the Smithiana Douglas, Douglas Pyramid and Douglas Golden arbor-vitæs are well known and widely planted today.

R. Douglas' Sons.

Downer, John S., pomologist and nurseryman, was born June 19, 1809, in Culpeper County, Virginia, and died in Kentucky in 1873. Like the man "born to fame" he seemed to evince a taste for horticulture from his earliest days. While yet a youth, without friends or fortune, he established and gradually built up the Forest Nursery, which gained an enviable reputation not only in Kentucky but in neighboring states. He was patient and painstaking and tested many varieties of fruits under his own inspection. He did much to improve pomology in the Central States. He paid special attention to the strawberry, and produced the well-known Downer (Prolific), (Chas.) Downing and Kentucky. These should perpetuate his fame, for it was at a time when the strawberry industry of the country was in its infancy. He introduced the Wild Goose plum and he conferred the blessings of pomology on the whole country by disseminating many choice varieties of fruit. He was quiet and unobtrusive, but was a man of worth and honesty. His nursery at Elkton, Kentucky, was for many years a fruit experiment station. He was vice-president for Kentucky of the American Pomological Society, and held other offices of trust and honor.

G. B. Brackett.

Downing, Andrew Jackson (Fig. 1877), the first great landscape gardener of America, was born at Newburg, New York, October 30, 1815, and perished by drowning July 28, 1852, at the early age of thirty-seven. As a boy, he was quiet, sensitive, and much alone with himself and nature. The Catskills, the Hudson, and his father's nursery had much to do with his development. His "Treatise on the Theory and Practice of Landscape Gardening," published 1841, when he was but twenty-six years old, is, in many respects, a unique production. It was the first, and is today one of the best American books on the subject, and has exerted a greater influence upon American horticulture, it is said, than any other volume. "Cottage Residences," 1841, also had great popularity. In 1845 appeared simultaneously in London and New York the first edition of "Fruits and Fruit Trees of America;" in 1846 he became connected with "The Horticulturist," which he edited from his home at Newburg until his untimely death. His editorials in this excellent periodical (later represented in succession by "American Gardening") were republished after his death, with a letter to his friends by Frederika Bremer, and a memoir by George William Curtis, under the title of "Rural Essays." It was not until 1850 that he had an opportunity to visit the great estates of England, to see with his own eyes the landscape gardening of Europe. On his return in 1851, he was engaged to lay out the grounds near the Capitol, White House, and Smithsonian Institution at Washington. On July 28, 1852, he left Newburg on the steamer Henry Clay for New York. The Clay took fire near Yonkers, while it was racing, and Downing's life was lost in an attempt to save others. It would be difficult to overestimate the influence of Downing. He created American landscape gardening. His only predecessor, André Parmentier, is little known, and his influence was not of a national character. Downing's quickening influence affected country life in its every aspect. He stood for the simple, natural, and permanent as opposed to the intricate, artificial, and ephemeral. He was the first great American practitioner of what is known in polite and technical literature as the English or natural school of landscape gardening in distinction from all artificial schools, as the Italian and Dutch. Downing's pupils are many, and his spirit still lives. He gave inspiration to Frederick Law Olmsted, our next great genius in landscape gardening, who, by his early work in Central Park, New York, aroused that popular enthusiasm which has culminated in the American idea of great municipal park systems, as opposed to the earlier Old World idea of exclusive pleasure-grounds and private parks. Downing's books have had large sales, and have gone through many editions. His intellectual successor in his purely pomological work was his brother Charles, whose modest labors in the revision of the "Fruits and Fruit Trees of America" have brought him little popular fame, but much sincere admiration from students. Most horticultural writings are, in reality, only records of progress; they do not create progress.

1877. A. J. Downing.

Few of our horticultural books are epoch-making. Downing's writings, however, started a great popular movement in America toward beautiful homes and home grounds. By many persons, Andrew Jackson Downing is considered the greatest single figure in the history of American horticulture, and one of the few persons who can be said to have had real genius. An appreciation of Downing's personality will be found in Frederika Bremer's "Homes of the New World." (See *Downingia*, for the genus of plants named after him).

WILHELM MILLER.

Downing, Charles, (Fig. 1878), distinguished pomologist and elder brother of Andrew Jackson Downing, the landscape gardener, was born at Newburg, New York, July 9, 1802. He was educated at the local academy, and from the age of thirteen to eighteen worked part of the time in his father's nursery. At the age of twenty he started in the nursery business on his own account. From 1834 to 1839 his brother Andrew was a partner in this business. About 1850, he sold out his nursery business and devoted himself to the study of varieties of fruits, on which subject he was the leading authority until his death. The "Fruits and Fruit Trees of America" is the monumental American work on varieties of fruits. The book was projected by Andrew, but the great bulk of the work was done by Charles in continuing and revising it. His test orchard contained trees and grafts of 1,800 varieties of apples, 1,000 pears, and other fruits in proportion. In 1896 a city street was put through it. Charles Downing was very modest and retiring. He would never make a public speech, but he wrote many pomological articles over the signature "C. D." All his work is marked by conscientious accuracy. He died January 18, 1885.

1878. Charles Downing.

WILHELM MILLER.

Dreer, Henry A., seedsman and florist, founder of one of the oldest American horticultural establishments, was born in Philadelphia, August 24, 1818, and died December 22, 1873, at the age of fifty-five. His parents were Frederick Dreer, of Hanover, and Fredericka Augusta Nolthenius, of Grossakenheim, Germany. They were married in America. The Nolthenius family emigrated to the United States in the last decade of the eighteenth century. Henry A. Dreer's education was largely in German, and obtained in Philadelphia. He was fond of gathering seeds and plants in the country, and would bring them home to cultivate. He was trained in his father's business, that of a cabinet-maker. In 1838, at the solicitation of a friend, he began as a seedsman and florist in a small way, at 59 Chestnut Street. In 1863 he moved his store to 714 Chestnut St., where the business has been conducted ever since with the addition of No. 716. His only son, William F. Dreer, succeeded his father and conducts the extensive business in Philadelphia and at Riverton, N. J.

Henry A. Dreer was of modest temperament and frail constitution, and confined himself to business rather closely. He was liberal in public matters, but always kept out of political life. He compiled several small works in connection with the business, and wrote frequently for the "Saturday Evening Post," of Philadelphia, and for Godey's "Ladies' Magazine."

WILHELM MILLER.

Dufour, John James, a Swiss vigneron, was at the head of a colony to grow the wine grape in Kentucky, and the author of "Vine Dresser's Guide," published in Cincinnati in 1826. The Kentucky experiment failed, and the colony then settled in southern Indiana, on the banks of the Ohio River; and this settlement is now the city of Vevay. Here Dufour died in 1827. This Indiana experiment brought out the merits of the Alexander grape, a native, and thereby did much to establish an American viticulture. For detailed account of the Dufours and their associates, and the results of their work, see Bailey, "Evolution of Our Native Fruits."

Eliot, Charles, landscape architect and author, passed away at Brookline, Massachusetts, early in the year of 1897. It is is said that no one of the present generation has shown greater ability in the art of landscape gardening on an extensive scale. From the time of his graduation until the time of his death, all his strength and energy had been given to the improvement of private grounds and public parks. A Harvard graduate, he took a post-graduate course at Bussey Institution, spending much of the time in studying the trees and shrubs in Arnold Arboretum. After familiarizing himself for a time with foreign parks and gardens, he entered the office of the late F. L. Olmsted, as a student. On completing his studies with Mr. Olmsted, he established his office in Boston and soon had a large clientele. He later became a member of the firm of Olmsted, Olmsted & Eliot and soon became identified with national undertakings with which he will long be remembered. While a member of the Appalachian Mountain Club, he was secretary and president of the corporation known as Trustees of Public Reservations, and from this organization sprang the admirable Metropolitan Park System. Mr. Eliot was the first landscape architect appointed by this Commission, and continued so until his death. To him, more than almost any other man, Massachusetts at least, is indebted for the improvement of her large tracts of land.

He was one of the best professional writers of his day on landscape gardening. His style was clear, earnest and convincing, and he allowed no minor matter to stand in the way of what he deemed the broadest and finest treatment, looked at from the future, and no other man during the past few years of Charles Eliot's life did so much toward crystallizing the better interests of the parking systems. To his work he brought vim, a trained intellect, a personal charm and a mature judgment. The public loss was great when Charles Eliot left his work.

G. B. BRACKETT.

Eliot, Jared, author of an early American book on agriculture, was born November 7, 1685, and died April 22, 1763. He was the grandson of John Eliot, the "apostle of the Indians," and was pastor at Killingworth, Connecticut, from October 26, 1709, until his death. He was a botanist, and the leading consulting physician in New England. He introduced the mulberry tree into Connecticut, wrote an essay upon the silkworm, and discovered a process of extracting iron from ferrugineous sands. His "Essays upon Field-Husbandry," begun in 1748, are generally regarded as the first important American book devoted exclusively to agriculture, although not actually the first work on the subject in the New World. It is now extremely rare. He was a high-minded, progressive and useful citizen. Many of his sermons were separately reprinted. Jared Eliot and Samuel Deane were among the few agricultural writers of note in the period before American horticulture was considered distinct from agriculture. See p. 1509; for portrait, "Cyclopedia American Agriculture," Vol. IV, p. 568.

WILHELM MILLER.

Elliot, Wyman, pioneer horticulturist, was born in Corinna, Maine, May 19, 1834, and died in Minneapolis, Minnesota, June 16, 1913. As a boy he helped his father about a grist-mill and on the farm and at odd times helped his mother in the fruit- and flower-garden, where he laid the foundation of his horticultural career. At the age of twenty the family went to Minneapolis, then a town of fifteen or twenty families. They purchased land and Mr. Elliot began raising vegetables and farm products. He was the first market-gardener in Minneapolis. In 1855 he took up a claim near Monticello in Wright County among the Indians, being one of the first farmers to till soil west of the Mississippi. In 1856 he returned to Minneapolis and took charge of the home place. He continued in the market-gardening business here for twenty-five years. He added fruits and ornamental stock to his crops and the place was known as the Minneapolis Garden Nursery for many years. By 1862 Mr. Elliot had built up a good market-gardening business. In 1864 he added a greenhouse and grew flowers and plants for sale. In 1866 a tree nursery was started and for many years supplied Minneapolis with trees, fruits and flowers. Many of the trees he planted will adorn the Minneapolis streets for many years and be a lasting monument to him.

In 1864 he helped organize the Hennepin County Horticultural Society and in 1866 helped organize and was a charter member of the State Horticultural Society. He was several times vice-president of the State Agricultural Society and held some office in the State Horticultural Society from its organization in 1866 until his death, serving as member of the executive committee, president six years, and from 1892 until his death he was chairman of the executive committee. Always of a quiet, unassuming character, he did work of untold value to the horticultural interests of the state.

LE ROY CADY.

Elliott, Franklin Reuben, died at Cleveland, Ohio, February, 1878. To him is due the honor of first suggesting and earnestly advocating the formation of state horticultural societies. He was secretary and a charter member of the Missouri Fruit Growers' Association, 1859; secretary of American Pomological Society, 1867, and a valued officer of the Ohio State Horticultural Society. He was a man of great ability in horticultural matters, and was the author of the "Fruit Book" and a well-known treatise on "Landscape Gardening." He was a valued contributor to the horticultural press at a day when American horticulture most needed advice.

G. B. BRACKETT.

Ellwanger, George, nurseryman, was born in Germany on December 2, 1816. His youth was spent in his father's vineyards where he acquired a love of horticulture and determined to devote his life to it. To this end, he studied horticulture in one of the leading institutions of Stuttgart. He came to the United States in 1835, and in 1839 settled at Rochester, New York. The next year he and Patrick Barry entered into partnership forming the nursery and seed firm, Ellwanger & Barry. Mr. Ellwanger was a member of the American Pomological Society, the Western New York Horticultural Society, and a corresponding member of the Massachusetts Horticultural Society. He died on November 26, 1906.

Emory, Robert Samuel, pomologist, was born April 2, 1832, near Centerville, on the Chester River, Maryland, and died June 2, 1906. His father was a lifelong agriculturist, carrying on that occupation most successfully until his death. Robert when a boy attended the public school, and later spent four years as a student in Dickinson College, Carlisle, Pennsylvania. Afterward he was employed as clerk in a wholesale drug-store in Pittsburgh, studying pharmacy, receiving a diploma, and remaining with the firm until he was twenty-one. He then returned home and engaged in agricultural work. In 1860, he settled near Chestertown, where he began the culture of fruit for market, on a considerable scale. He soon came to be regarded as an authority on all subjects connected with the production of fruit. His orchards comprised extensive plantings of pears and peaches, with a specialty of pears, and probably he raised more of this variety of fruit than any one east of California. In his orchard there were about 20,000 trees in bearing condition. His reputation as a skilful fruit-grower gained for him prominence, and his place on the Chester was the frequent resort of those concerned in fruit-culture from all sections desirous to see for themselves his well-managed orchards, to learn his methods, and to profit by his experience, the results of his own endeavors at individual research. In 1877, he was awarded the first prize for the best twenty-one varieties of pears by the American Pomological Society.

When the San José scale appeared in the East, he was among the first to recognize it as a deadly enemy, but by applying whale-oil soap saved his orchards until other remedies were discovered. All scientists were cordially welcomed to his home and orchards, enjoying the advantage which his experiences could give them. Captain Emory became a member of the Peninsula Horticultural Society a few years after it was organized and served as president during one year.

E. W. EMORY.

Ernst, Andrew H., nurseryman and pomologist, was born in Germany in the year 1796. He was proprietor of one of the earliest established and best nurseries in Ohio. He was a pioneer and champion of pomology in Ohio and the Northwest. Mr. Ernst established Spring Grove Cemetery in Cincinnati, one of the most beautiful cemeteries in the United States. He was vice-president of the American Pomological Society and president of the Ohio Pomological Society from 1847 until his death, which occurred on February 13, 1860.

Evans, James Calvin, one of the pioneer fruit-growers of the Mississippi Valley and for years one of the leading horticulturists of that section, was born in Jackson County, Missouri, April 25, 1833 and died in 1909. He was of a strictly pioneer family in western Missouri, being the son of Wm. B. Evans, who died in 1855, and nephew of the late Col. Milton McGee, so well and honorably known in the annals of Kansas City. In 1861 he acquired an extensive home plantation, in what is now North Kansas City. Being passionately fond of horticulture, he began its adornment and the development of extensive fruit-plantations. At the age of twenty-six he became a charter member of the Missouri Fruit Growers Association, organized in Jefferson City in 1859, its name being changed to the Missouri State Horticultural Society in 1862. This is the oldest permanent horticultural organization west of the Mississippi. He was elected president of this society in 1876 and served efficiently in this capacity for more than twenty years. He was also a charter member of the Missouri Valley Horticultural Society organized in 1868, and served as its president for twenty-three years. He was also a life member of the American Pomological Society and other horticultural bodies, which he has served from time to time as an officer or on important committees. In 1883 he organized the Olden Fruit Company and began planting the famous 1,400-acre orchard at Olden, which was the first extensive commercial orchard in the Ozark region. Due to the success of this enterprise and largely through his advice as to varieties and methods of orchard management found to be best adapted to that section, scores of extensive orchards began to be planted in the Ozarks. On his home plantation at Kansas City as well as at Olden, he maintained large areas for testing the adaptability of varieties of fruits to the western sec-

tion. He was also ever on the alert to locate promising specimens of wild fruits of the state, especially grapes, raspberries, wild crabs and persimmons. The orchards which he planted still contain (1914) a large collection of these wild fruits, which were in process of amelioration at the time of his death. Among his special contributions to the list of varieties originated in the state may be mentioned the Miller persimmon, Evans peach, Evans raspberry and Evans crab, the latter being a large-fruited form of the native crab *Pyrus ioensis*. It was largely through his assistance and advice that an extensive experiment in breeding apples was inaugurated at the South Missouri Fruit Experiment Station in the nineties. As a result of this work hundreds of varieties, crosses between leading commercial sorts, were originated with the hope that some might combine the more desirable characteristics of both parents. This work is now being conducted by Colonel Evans' oldest son, who is disseminating these new sorts, many of which have much promise in the state. The writings of Colonel Evans consist largely of horticultural papers which have appeared during the past fifty years in the Reports of the Missouri State Horticultural Society. J. C. WHITTEN.

Fessenden, Thomas Green, editor and author, 1771–1837, founded "The New England Farmer" at Boston in 1822, and edited it until his death. The present "New England Farmer" is not the lineal successor of Fessenden's paper. Fessenden is chiefly noted as a satirical poet, and he was more of a literary man than a gardener. He was born at Walpole, New Hampshire, was graduated at Dartmouth College in 1796, and studied law. He went to England in 1803, and there published his humorous poem, the "Terrible Tractoration." He settled in Boston about 1804. In addition to "The New England Farmer," he edited the short-lived "Horticultural Register," and "The Silk Manual." He wrote "The Complete Farmer and Rural Economist," "The New American Gardener," and "The American Kitchen Gardener," three books of a cyclopedic nature designed to cover the fields of agriculture, horticulture and vegetable-gardening respectively. They adhered very closely to the contemporaneous English type of horticultural writing. These books appear to have passed through many editions, but they were little altered from issue to issue. They often seem to lack the enthusiasm of direct contact with growing plants. Fessenden's time was one of general farming, and the viewpoint of gardening was mostly that of the home or amateur. He lived before the days of specialized farming on a large scale, and of commercial horticulture and floriculture. During the greater part of his editorship of "The New England Farmer" there was but one other important American agricultural paper, "The American Farmer," which was published at Baltimore, beginning 1819. The most important contemporaneous American writings on horticulture of a cyclopedic nature were "The American Gardener's Calendar," by Bernard M'Mahon, Philadelphia, 1806, and "The American Gardener" of John Gardiner and David Hepburn, Georgetown, District of Columbia, 1804. For a copy of "The Country Lovers," Fessenden's once famous song to the tune of Yankee Doodle, together with Hawthorne's pen-picture of the man, and an account of his interesting life, see Duyckinck, "Cyclopedia of American Literature," 595–599. WILHELM MILLER.

Fuller, Andrew S. (Fig. 1879), horticultural writer, was born in Utica, New York, on August 3, 1828, and died May 4, 1896, at his home at Ridgewood, New Jersey. At the age of eighteen he went to Milwaukee, Wisconsin, where he worked at the carpenter's trade, and became particularly skilful in the construction of greenhouses, and built a small one for himself on a city lot. Here he brought together a varied collection of plants, the care of which founded the nucleus of his later attainments and renown as a horticulturist. In 1855, he moved to Flushing, Long Island, when William R. Prince offered Mr. Fuller the management of his greenhouses. But his ambition did not allow him to remain long in the employ of others, and in 1857 he removed to Brooklyn, and engaged in grape and small-fruit culture, which were then in their infancy. Here he gave particular attention to the improvement of the strawberry by cross-fertilization and selection of the best of the many thousands of seedlings raised by him. The most famous of these were Brooklyn Scarlet, Monitor and Colonel Ellsworth, the first of which was generally recognized as the highest-flavored strawberry in existence at the time, although too soft for market. The entire stock of 300,000 plants was purchased by the "New York Tribune," which sent them out as premiums to its subscribers, in consequence of which they have been widely known as the "Tribune strawberries." It was during this period that Fuller wrote his first book, the "Strawberry Culturist." Realizing the necessity of having more ground for experimentation, and in order to escape the noise and turmoil of the city, he bought a large piece of land near Ridgewood, New Jersey. This, when he moved on it, early in the sixties, was little more than a barren waste, but it developed into one of the most charming homes and interesting and instructive garden spots in the country. Almost every species and variety of ornamental trees and shrubs hardy in the locality were represented, and his collection of small-fruits was the most complete in the country. Immediately after the publication of the "Strawberry Culturist," he began working on the "Grape Culturist." This was followed by the "Small Fruit Culturist," "Practical Forestry," "Propagation of Plants," and the "Nut Culturist." The last of them he was fond of calling his "monument," as he did not intend to write another book, and so fate decided that it should be. He died a few days after he had finished his manuscript, and never saw the completed book, of which he was perhaps more proud than of any other of his works, yet in the history of horticultural literature his "Small Fruit Culturist" will, no doubt, occupy the foremost rank. It was more instrumental in the development and building up of the great industry to which it is devoted than any book written before or after, and in any land. It was translated into German and published in Weimar in 1868. His books contain but a small part of his writings. His editorial and other contributions to the "American Agriculturist," to "The Rural New-Yorker," of which he was part owner for a time, the "New York Sun," of which he was agricultural editor for twenty-six years, "American Gardening" and other periodicals would fill hundreds of volumes. He was also editor of the "Record of Horticulture," 1866 and 1867. While Mr. Fuller was principally known as a horticulturist, there was hardly a branch of natural science to which he had not devoted more or less attention. His entomological collection, especially that of coleoptera, was one of the most complete in the country; his mineralogical and archeological collections contained many rare specimens, and his horticultural library was one of the best

1879. Andrew S. Fuller.

in the United States. In later years, although in good health, Mr. Fuller left his place but seldom, but in his earlier years he traveled considerably, and took an active and leading part in the meetings of the American Pomological Society, the American Institute Farmers' Club, the Fruit-Growers' Club, and many kindred societies, of which he was an active or honorary member. F. M. HEXAMER.

Fulton, J. Alexander, lawyer and horticulturist, was born at his father's farm in Armstrong County, Pennsylvania, November 11, 1822, and died in 1895. He removed from Pennsylvania to Dover, Delaware, in 1865. Although a lawyer by profession, he was much interested in fruit-culture and was known as a horticulturist far beyond the limits of his state. His book on "Peach Culture" was long a standard work. He was one of the early members of the Peninsula Horticultural Society and participated in its meetings until the end of his life. G. B. BRACKETT.

Gale, Elbridge, pastor and horticulturist, was born on Christmas Day, 1824, in Bennington, Vermont. and died at Mongonia, Florida, in 1907. He attended Brown University and was later graduated from the Baptist Theological Seminary at New Hampton, New Hampshire. His first pastorate was at Johnson, Vermont; from thence he accepted a call to the Baptist church of Pavilion, Illinois, and on going to Kansas in 1864, became the pastor of the Baptist church at Manhattan. He remained in this pastorate until he accepted the chair of horticulture at the Kansas State Agricultural College. He was greatly interested in the free schools of Kansas and was County School Superintendent of Riley County for several terms. He was one of the founders of the Manhattan Horticultural Society. He removed to Lake Worth, Florida, November, 1884, on account of his failing health. His interest in horticulture grew apace in the Lake Worth section. He was first president and an active member of the Lake Worth Horticultural Society as long as it was in existence, and it was largely through his efforts that the United States Government procured from India some Mulgoba mangoes and from Italy some mangosteens, durians and figs for distribution to the planters connected with the Society. Of all the Mulgoba mangoes planted, Mr. Gale was the only one who succeeded in keeping the trees alive, and the Mulgoba mango still remains a living monument to his success as a Florida horticulturist. His skill and energy has given to the western world another fruit that adds much to tropical luxuriance and American finance.

His was a busy life. At the college at Manhattan he planted the college arboretum east of Horticultural Hall and the forest plats on the old college farm. In 1879 he was candidate for Congress from the First Kansas District, greenback platform.

To his activity, usefulness and teachings, thousands of pioneer Kansans and students of the College are indebted to this grand old man who sleeps beneath the live oaks and the palms of his new home State in the Southland. G. B. BRACKETT.

Gano, William Groves, pioneer horticulturist of the Missouri Valley and introducer of new varieties of fruits, was born in Winchester, Virginia, in 1839 and died at Parkville, Missouri, in 1910. In 1867 he moved to Parkville, Missouri, where he planted one of the notable early orchards of that section and spent most of the active working part of his horticultural career. He was associated with J. C. Evans and others in establishing and planting the Olden Fruit Farm, the pioneer large commercial orchard of the Ozark region. Throughout his residence in Missouri, he was a member of the Missouri State Horticultural Society and served frequently as an officer of this body. He was also a charter member of the Missouri Valley Horticultural Society and held membership in other state and national organizations. He was actively identified with collecting state fruit exhibits at all of the leading national and interstate expositions which have been held during the past fifty years. He was awake to the desirability of introducing and testing large numbers of varieties of fruits on his farm at Parkville. His orchard served largely as a model for the guidance of other orchardists in his own section and his advice and judgment as to what varieties to plant and how to adapt orchard management to this pioneer section of the Missouri Valley was sought throughout several states. In addition to giving his time and his resources freely to this type of work, he was zealously interested in the production of new seedling varieties of fruits. Several of these have gained local prominence because of their adaptation to local conditions. His most celebrated contribution to our list of varieties was the Gano apple, named in honor of the originator by Charles Downing. The Gano apple is similar to that most cosmopolitan Ben Davis, equal to it in every respect, but due to its superiority over Ben Davis in color and beauty of appearance, it is now displacing the latter in commercial orchards of the West. The annual reports of the Missouri State Horticultural Society contain many of his papers dealing with the problems and practices of fruit-growing which he helped to shape in the region in which he did his work. J. C. WHITTEN.

Garey, Thomas Andrew, nurseryman, was born in Cincinnati, Ohio, July 7, 1830, and died at Los Angeles, California, August 21, 1909. He was of German stock and spent his boyhood partly in Hagerstown, Maryland, and partly in Iowa. In the spring of 1850, Mr. Garey moved to New Mexico, traveling by ox-team over the Santa Fe trail. In 1850, after having married in New Mexico, the Gareys crossed the mountains and settled at El Monte in Los Angeles County, California, where he engaged in farming. In 1865 Mr. Garey purchased 72 acres of land on what is now South San Pedro Street, Los Angeles, and entered the nursery business. He soon built up a large and thriving business and was very active in introducing many kinds of tropical and semi-tropical fruits from various parts of the world. It was Mr. Garey who first demonstrated to the citrous growers that budded trees of improved varieties were better than the seedlings which were commonly grown. Hearing of the Bahia Navel orange, Mr. Garey attempted to introduce it from Australia, but was unfortunate in securing an undesirable type (Australian Navel) which was subsequently displaced by the true Bahia or Washington Navel. Recognizing the value of a seedling lemon grown by C. R. Workman, Mr. Garey bought the original tree and introduced the variety in 1877 under the name Eureka. This variety is now the leading commercial lemon in California. Mr. Garey did a large business in importing all kinds of plants and seeds and had wonderful success with many of the novelties he brought in. He served for a time as president of the Los Angeles Pomological Society and was one of the founders of the city of Pomona. In 1882 he published "Orange Culture in California," which for years was considered a standard reference book. J. ELIOT COIT.

Gibb, Charles, Canadian horticulturist, and author of important works on Russian fruits and other hardy trees, was born at Montreal June 29, 1842 (Woolverton says 1846) and died at Cairo, Egypt, March 8, 1890, while returning from a collecting trip in China and Japan. In 1872 he brought to Montreal the first canned fruit exhibited in Canada. His farm at Abbotsford, Province of Quebec, contained the best collection of hardy fruits, trees and ornamental shrubs in Canada. His trip to Russia in 1882 with Professor Budd, the subsequent importations, his second trip to Russia,

and his various publications on hardy trees make part of a chapter of great interest and significance in the history of American horticulture. His travels were extensive. His chief works are "Ornamental and Timber Trees not Natives of the Province of Quebec" (a comprehensive list of species of possible value for Canada), "Report on Russian Fruits," "Hasty Notes on the Trees and Shrubs of Northern Europe," "Russian Apples Imported by the Department of Agriculture, Washington, in 1870" (an elaborate comparison of Russian opinions and American experience), "Nomenclature of the Russian Apples," "Of Translating and Rendering into Euphonious English Unpronounceable Russian Names, also Throwing Out Synonyms," and "Fruits for the Cold North." For a fuller account, with portrait, see "Annals of Horticulture," 1890, 287–290. WILHELM MILLER.

Gideon, Peter M., pioneer pomologist of the northern Mississippi states, 1818–1899, resided since 1853 on Lake Minnetonka, Minnesota, and devoted his efforts to the production of apples of sufficient hardiness to withstand the climate. He was born in Ohio. He afterward lived in Illinois. From boyhood he seems to have been possessed of the idea to raise seedling fruits. He was one of those rare individuals who sets a distinct ideal and strives for it throughout a lifetime in spite of every adversity. These are persons of strong and uncompromising will. They often antagonize their fellows; but their works are usually beneficent. Gideon conceived that the amalgamation of the Siberian crab and the common apple would give the perfect apple for the Northwest. His seedlings were numerous. Several of them have been named and disseminated, and are of value. But his greatest achievement, the Wealthy apple, was of pure *Pyrus Malus* stock. This variety is now one of the standard apples of his geograpical region, and it is also in favor elsewhere. It is a boon to the Northwest. Even when in poverty, it is said that Mr. Gideon spent his last dollar to buy the seeds from which this apple came. He was instrumental in distributing 10,000 apple seedlings in Minnesota, and some of these are now attracting attention. His work was wholly empirical, yet he did so much and continued his work for so long a time that the results have contributed to the knowledge of plant-breeding. Probably no other American has labored so long and devotedly for the attainment of a specific ideal in the apple. Portrait and eulogies will be found in "The Minnesota Horticulturist," January, 1900. L. H. B.

Goff, Emmett Stull, horticulturist, was born on a farm near Elmira, New York, in 1852. In 1882, he was appointed horticulturist at the Agricultural Experiment Station at Geneva. In 1889, he was called to the University of Wisconsin as professor of horticulture and horticulturist of the experiment station. He did valuable work in producing new and hardy varieties of plums for the colder portions of the Northwest. He was a pioneer in spraying and invented the kerosene attachment for spray pumps. Professor Goff performed the first successful experiments with fungicides for the control of the apple-scab fungus. He was the author of "Principles of Plant Culture," and "Lessons in Pomology" and wrote the first classifications of vegetables published in America. He also published many bulletins and papers in horticultural publications. He was a good systematic botanist as well as a horticulturist. He died at Madison, Wisconsin, on June 6, 1902. For portrait and fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 576.

Goodrich, Chauncey, bookseller and horticulturist, was born September 10, 1798, and died September 11, 1858, at Hinsdale, Massachusetts. At nineteen years of age he entered a publishing house, but a few years later took up bookselling and publishing on his own account, finally settling at Burlington, Vermont. He was very much interested in gardening, testing fruits for hardiness in the Champlain Valley and maintaining a nursery on his farm. He did much to improve and extend the culture of fruits in northern New York and Vermont. He was a contributor to horticultural magazines and author of "The Northern Fruit Culturist, or Farmer's Guide to the Orchard and Fruit Garden." For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 579.

Green, Samuel B. (Fig. 1880), horticulturist and educator, was born in Chelsea, Massachusetts, September 15, 1859, and died in Itasca Park, Minnesota, July 11, 1910. His father was one of the early mayors of Chelsea and held many offices of trust. As a boy, Professor Green spent his summers on a New Hampshire farm and early developed a liking for farm life, culminating in his taking the agricultural course at Amherst, in spite of strong opposition from his family and friends, who wanted him to take up other work. He worked a large part of his way through college, graduating in 1879. Immediately after he graduated, he became superintendent of the Vine Hill Dairy Farm, of West Hartford, Connecticut. After a year's experience, he decided there was not a great future for agriculture in the East and took up gardening and nursery work. He worked for a market-gardener near Boston one season, then took a six-months' post-graduate course at Amherst. The next season he worked for James J. H. Gregory, and in the winter, for William C. Strong, a rose-grower and nurseryman of Brighton, Massachusetts. About 1884 he took charge of the Horticultural Department of Houghton Farm Experiment Station, at Cornwall, New York. He made many interesting experiments here and also had the opportunity to get some landscape gardening training under Samuel Parsons, Jr., who was employed to develop the Houghton Farms of over 1,000 acres. Thinking that he was not getting enough experience here, he returned to Mr. Strong's nursery especially to learn summer propagation of plants, later becoming foreman of Newton Cemetery nurseries. From here he returned to Massachusetts Agricultural College as foreman of the horticultural department. He remained here until 1888 when he accepted the position of professor of horticulture and applied botany in the University of Minnesota and horticulturist of the experiment station. Later his title was changed to professor of horticulture and forestry, and in 1910 he was made dean of the College of Forestry. He was a member of the Executive Board of the Horticultural Society, Forestry Board, American Pomological Society, Society of American Foresters and American Forestry Association. At the time of his death, he was president of the State Horticultural Society and of the State Board of Arbitration.

1880. Samuel B. Green.

Professor Green wrote many books and bulletins and contributed to the agricultural literature generally.

His best known publications are: "Amateur Fruit Growing," 1894; "Vegetable Gardening," 1896; "Forestry in Minnesota," 1898; "Principles of American Forestry," 1903; "Farm Hedges and Windbreaks," 1906; "Popular Fruit Growing," 1909.

He was one of the pioneers who helped to put agriculture in its proper place in the state of Minnesota. He was instrumental in establishing the College of Forestry and started the summer work in Itasca Park, thus giving the forestry students six months of practical work under good supervision. LE ROY CADY.

Gregory, James J. H., farmer, seedsman, and author, was born at Marblehead, Massachusetts, November 7, 1827, and died February 20, 1910. He was educated in the public schools at Marblehead, two years at Middlebury College, and graduated from Amherst College in 1850. He taught in Marblehead, Hingham and Lunenberg. The starting of the seed business was almost an accident. He was reading the "New England Farmer" and saw the request for a good winter squash, and as his father had recently raised some splendid squashes from seed that "Old Marm Hubbard" had given him, he sent the inquirer some of this seed. The man was so well pleased that he wrote articles for several papers extolling these squashes, and soon the Gregory Seed Business was thriving, sending Hubbard squash seed to all parts of the United States. Naturally the business started in the home, the attic being used for the purpose; in a very short time it was necessary to move to larger quarters. He branched out with other seed, both vegetable and flower, and at the time of his death was carrying on one of the largest seed establishments in the country. During his career he introduced many new varieties of vegetables, several of which are the standards in the market today. His seed-farms comprised over 400 acres where he grew pedigreed stock; he always felt that by growing his own seeds he was less liable to mistakes and could, himself, select the most perfect types. His reputation for choice varieties was so renowned that the firm became the headquarters for stock seeds for other well-known concerns.

He wrote and distributed many thousands of copies of treatises on various agricultural subjects, such as: "Onion Raising," 1865; "Squashes: How to Grow Them," 1867; "Cabbages and Cauliflower," 1870; "Carrots, Mangold Wurtzels and Sugar Beets," 1877; "Fertilizers," 1885. In his early life he lectured extensively on agricultural and horticultural subjects.

Mr. Gregory was a philanthropist of renown. He gave large sums of money for the establishment of southern schools and colleges, the Gregory Institute of Wilmington, North Carolina, being founded by him. He served his native town in many responsible capacities and filled many public offices. EDGAR GREGORY.

Hall, Dr. George R., plant collector, was born in Bristol, Rhode Island, in 1820, and died in Milton, Massachusetts, December 24, 1899. He was a graduate of Trinity College, Hartford, Connecticut, in the class of 1842. He studied medicine at the Harvard Medical School, class of 1846, and on receiving his degree went to China, where he practised medicine in the foreign settlement in Shanghai. He abandoned the practice of medicine in 1854 and went to Japan, where he traveled extensively and collected the plants which bear his name, among which may be mentioned *Lonicera japonica* var. *Halliana*, *Pyrus Halliana*, *Magnolia stellata* (*M. Halliana*), *Zelkova Keaki*, *Retinospora*, *Thujopsis*, and *Lilium auratum* which flowered in this country one month earlier than in England. In 1864 he planted at Bristol many Japanese evergreens at that time very rare in this country. In 1876 he made a second visit to Japan.

Harris, John S., horticulturist and pomologist, was born in Seville, Ohio, August 17, 1826, and died at La Crescent, Minnesota, March 24, 1901. His ancestors were hardy pioneers of Massachusetts and Connecticut, and his own parents were pioneers in Ohio. Mr. Harris early became a skilful propagator of plants under the direction of his father and at the age of eleven had a small nursery and garden of his own. After his father's death in 1844, he was apprenticed to a cabinet-maker to learn the business. In 1847 he enlisted for the Mexican war and served under General Scott in the campaign resulting in the capture of Mexico City. After his return from the war, he stayed in Ohio a year or so and then went west to Wisconsin, traveling over Wisconsin, Iowa and Illinois. In 1851 he settled at La Crosse and engaged in market-gardening. The soil proving too poor and sandy, in 1856 he removed to La Crescent and started in the fruit, garden and florist business.

He planted his first orchard in 1857 and continued planting trees, plants and shrubs until the last few years of his life. It was his pride that he had tried nearly every variety of apple that offered any likelihood of being valuable to Minnesota planters. The winters of 1872 and 1884 destroyed nearly all of his trees but he continued planting. He began to attend fairs and exhibit fruits of his own growing in 1864. In 1866 he helped organize the State Horticultural Society and his is the first name on the roll of the Society. In 1868 he was elected vice-president and in 1869, president. He held the office of president until 1871, and again from 1881 to 1884. He was a member of the executive committee from 1884 until his death. He was elected to the Board of Managers of the State Agricultural Society in 1875 and held the office for twelve years. Mr. Harris exhibited at the state fair every year and his exhibits were always interesting and valuable as showing the pomology of the state. He was one of the first men to be made an honorary life member of the Horticultural Society. He enjoyed writing for the agricultural papers and conducted a column in the "Farm, Stock and Home" for many years. Mr. Harris probably had a closer knowledge of pomology in the Northwest than any other man in the United States and did his full share in the development of horticulture throughout Minnesota.

LE ROY CADY.

Heikes, William Fletcher, nurseryman, was born at Dayton, Ohio, on April 2, 1837. He succeeded his father in the nursery business near Dayton, in 1839. In 1872 he established near Huntsville, Alabama, what eventually became the largest nursery of its kind in the United States. He was instrumental in introducing systematic grading and was the first nurseryman to use a caliper to determine tree grades. He was also the first nurseryman to cellar nursery stock and keep it in cold storage during the shipping-season. Mr. Heikes originated the double root-grafting method of propagation of nursery stock. He was state vice-president for Alabama of the American Pomological Society for many years. He was president of the Alabama Horticultural Society from its origin in 1903 to the time of his death in Cleveland, Ohio, on Friday, August 25, 1911. P. F. WILLIAMS.

Henderson, Peter (Fig. 1881), leading market-gardener, florist, seedsman and author, was born at Pathhead, near Edinburgh, Scotland, in 1822, and died in Jersey City, January, 17, 1890. He was trained in Old World methods of gardening, came to America in 1843, worked under Thorburn and Robert Buist, and then in 1847 began business in Jersey City as a market-gardener, with a capital of $500, saved by three years' hard work. He continued to live there until his death. The publication of "Gardening for Profit" in 1865 marks an era in American horticulture. It was the first American book devoted entirely to market-gardening, and it helped to induce many per-

sons to enter the business. By the time of his death about 150,000 copies of the book are said to have been distributed. It was written in an aggregate of 100 hours, when the author was working 16 hours a day, largely at manual labor. At the noon intervals and late at night he wrote this work lying on his back, with a pillow under his head. The secret of its success and of the author's, was the invention of new methods adapted to operations on a large scale. The second edition in 1874, and the third in 1887, are both thorough revisions.

1881. Peter Henderson.

"Henderson's Practical Floriculture," 1868, was an epoch-making book in commercial floriculture. Up to this time most works on flower-gardening had been written for the amateur. This point of view is necessarily the commoner one, and Henderson's contribution to it was "Gardening for Pleasure," 1875. In the compilation of "The Handbook of Plants," in 1881, he was largely aided by C. L. Allen, and in the second edition, 1890, by W. J. Davidson. "Garden and Farm Topics" was issued in 1884, and in the same year appeared "How the Farm Pays," a stenographic report of conversations between Wm. Crozier and Peter Henderson. It is said that nearly a quarter of a million copies of his various works have been sold. His seed business was founded at New York in 1865.

Few men, if any, have done so much to simplify and improve methods of handling plants for commercial purposes. His greenhouses were an object lesson to many visitors, his methods were widely copied, and his business successes were the goal of ambitious market-gardeners and florists, among whom he was for many years the most commanding figure. He was a frequent contributor to the horticultural and agricultural magazines, and during his forty-two years of business life is supposed to have written or dictated at least 175,000 letters. Two-thirds of these letters were written with his own hands, and he always replied promptly to inquiries about methods of cultivation. An account of his life is published in a memoir of forty-eight pages by his son, Alfred Henderson. WILHELM MILLER.

Hepburn, David, was joint author with John Gardiner of a very early American book on horticulture. This was published at Washington, D. C., in 1804. The name of Gardiner appears first on the title page, but it may be inferred that the practical experience in the book is almost wholly Hepburn's. He had had forty years of experience in gardening, half of the time in England and half in America. He was employed by General J. Mason for six years on Mason's Island, Georgetown. He had also been employed by Governor Mercer. The book was well made for the time. It is a 16mo, and contains 204 pages of practical directions. The calendar style is used. The first part (100 pages) is devoted to the kitchen garden. The second part consists chiefly of fruits, flowers, and shrubs (82 pages). This is followed by a few pages on hops, hot-houses and greenhouses. The second edition (Georgetown, 1818) contains 348 pages. It includes "A Treatise on Gardening, by a citizen of Virginia." This occupies 80 pages. The copy owned by the Massachusetts Horticultural Society possesses this manuscript note: "This treatise is by John Randolph, of Williamsburg, father of Edmund Randolph, Secretary of State during the administration of General Washington." Robert Manning said that this note may have been made by General Dearborn. A third edition was published at Washington in 1826, and contained 308 pages. For a further account of the book by Gardiner and Hepburn, see page 1521. WILHELM MILLER.

Hexamer, Frederick M. (Fig. 1882), physician, nurseryman and editor, was born at Heidelberg, Germany, on June 21, 1833. He died at Stamford, Connecticut, May 29, 1909. When only sixteen years of age, he joined Siegel's army which was disbanded in 1848, and he, the youngest in the ranks, being exiled, went to Switzerland, where he became acquainted with the elder Froebel with whom he studied medicine and botany in the Zurich botanical gardens. Having secured his M.D. degree, he explored the Swiss Alps and the Tyrol and made a very large collection of Alpine plants. The remains of this collection are now in the herbarium of the botanical gardens at Bronx Park, New York City. About the middle of the last century, he came to New York and began the practice of medicine, which, however, he soon dropped to enter the nursery business at Chappaqua, New York, in partnership with his father-in-law, a leading physician of New York City, under the name of Reisig & Hexamer. The firm's principal business was the growing of new varieties of plants to be distributed as premiums with the "New York Tribune," to which paper Dr. Hexamer became a contributor through his friendship with Horace Greeley. His writings were upon horticultural and agricultural topics. Thanks to his friendship with B. K. Bliss, he became editor of the "American Garden" in 1880. In 1885 he succeeded Dr. George Thurber as editor of "American Agriculturist," to which paper he had contributed frequently during many years. He continued as editor of the "Agriculturist" until the early years of this century, when he was made editor emeritus. His activity during his connection with the "Agriculturist" had also to do with the editing of a large number of books on rural affairs published by the Orange Judd Company. His only book, "Asparagus," the sole work on this subject published in America, was printed in 1901.

In addition to the influence which he exercised on American farm affairs as editor, Dr. Hexamer was a leading spirit in horticultural and agricultural associations. He was for years on the New Fruits Committee of the American Pomological Society and was president of the Farmers' Club of the American Institute of New York City, his immediate predecessor being Horace Greeley. In this institution, he mapped the policy of the club which practically took its life and usefulness from him. However, owing to his excessive modesty, his hand was not often seen and only too frequently others seized the credit which was really due to him.

1882. F. M. Hexamer.

Some of his achievements in the commercial line had to do with the growing of strawberries and potatoes. He was the first man to grow the former on a business basis for the New York market. He also grew the

epoch-making Early Rose potato for the introducers and was awarded a medal at the Centennial Exposition at Philadelphia in 1876 for a collection of 550 named varieties of potatoes. M. G. KAINS.

Hiester, Gabriel, horticulturist, was born at "Estherton," near Harrisburg, Pennsylvania, April 28, 1850, and died in his lifelong home, January 18, 1912. His father, Augustus Otto Hiester, was a prominent citizen and an influential trustee of the Pennsylvania State College. Gabriel Hiester graduated from this institution in 1868 and served as a trustee from 1878 until his death. No member of the board did more for the promotion of agriculture, and especially horticulture, in the college and in the agricultural experiment station. He was elected President of the State Horticultural Association in 1905 and was serving his eighth term on the evening before his death. Mr. Hiester was widely known as an unusually successful horticulturist. He produced fruits and vegetables on a large scale for the markets of central Pennsylvania and frequently attended Farmers' Institutes and horticultural meetings in this and other states where he gave his hearers the benefit of his many years of experience as a grower of choice products. Gabriel Hiester was a man of sterling qualities, being broad-minded, unselfish, and thoroughly devoted to all interests which concern the welfare of mankind. R. L. WATTS.

Hogg, Thomas, Senior and **Junior,** plantsmen. The second Thomas Hogg, born in London, February 6, 1820, died in New York, December 30, 1892, was known for his introductions of Japanese plants. His father removed to this country in 1820, when the child was nine months old, and early in 1822 took up a piece of land outside the city of New York, at what is now Broadway and Twenty-third Street, and here established himself as nurseryman and florist. In 1840, the nurseries were removed to Seventy-ninth Street and East River, where young Thomas and his brother James assisted in the business. The father died in 1855, and the sons took charge of the business. Thomas Hogg was appointed by President Lincoln, in 1862, United States Marshal, and in this capacity he resided eight years in Japan. He returned to Japan in 1873, and remained two years in the Japanese customs service. "His close relations with the authorities gave him opportunities for exploring the islands which other foreigners did not possess, and he collected many plants and seeds of horticultural value and sent them home. The garden of his brother at the foot of Eighty-fourth Street, where most of these treasures were cultivated for the first time in America, was, for many years, the most interesting spot in the United States to the lovers of Japanese plants. Many of the very best trees, shrubs and herbaceous plants which have come to us from Japanese gardens were thus brought to America before they were sent to Europe, and not a few of them are now among the most familiar inhabitants of our gardens." Hogg left Japan in 1875, and subsequently traveled in China, Ceylon, South and Central America, as well as in Europe and California. In later life he devoted himself to his favorite studies. He never married.—Extract from "Garden and Forest," Vol. VI, p. 24.

Hoopes, Josiah, nurseryman, was born in West Chester, Pennsylvania, November 9, 1832, and died January 16, 1904. He was reared principally in Philadelphia and received a superior English and classical education in the high schools of that city. His chief delight was in botany, and from early childhood he pursued that line of study with interest. It was in pursuance of his inclinations along this line that he built in 1853 a small greenhouse on his father's property and proceeded, at great labor and considerable expense, to fill it with specimens of the flora of this continent and of the world. To this collection he added as opportunity permitted and naturally began propagating them and found his products in demand. From that small beginning, the great and prosperous nursery business of today was developed. Josiah Hoopes wrote much on horticulture, botany and kindred subjects, for many years being a regular contributor to the horticultural department of the "New York Tribune" and other publications. He was the author of the "Book on Evergreens."

Hoskins, Thomas H., physician, horticulturist and writer, was born at Gardiner, Maine, in 1828 and died at Newport, Vermont, in 1895. He was well known in horticulture as the introducer of Russian fruits. He was also a contributor to all the the leading horticultural papers. For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 585.

Hovey, Charles Mason (Fig. 1883), horticultural journalist and nurseryman, was born in Cambridge, Massachusetts, October 26, 1810, and died there September 1 or 2, 1887. He is best known as editor of the "Magazine of Horticulture," which had an uninterrupted existence from 1835 to 1868. It was founded as the "American Gardener's Magazine," by C. M. Hovey and his brother, Phineas Brown Hovey. In its third volume (1837) it changed its name, and continuously thereafter was known as the "Magazine of Horticulture," and was edited by Charles M. Hovey alone. It enjoyed the longest period of prosperity of any American horticultural journal. It is a record of the budding stage of New World horticulture. It was modeled after Loudon's "Gardener's Magazine," although its spirit was essentially American. Essays, records of current events, reviews of books, descriptions of varieties, were prominent features. It had very few illustrations. Mr. Hovey was author of the "Fruits of America," issued in parts from 1852 to 1856, completing two volumes and making more than a beginning on a third. Its purpose was to give "richly colored figures and full descriptions of all the choicest varieties cultivated in the United States." The volumes contain more than 100 colored plates. Handsomely printed and bound, these volumes are a fine type of the amateur's art-book of varieties.

Mr. Hovey was also nurseryman and seed merchant. Until 1840, his grounds at Cambridge are said to have comprised only an acre, but at that time his premises were greatly enlarged. His epoch was a time of knowledge of varieties. Straightway he began assiduously to collect varieties, until he exhibited pears, apples and camellias by the hundreds, and plums, grapes, chrysanthemums and many other things by the score. These things were shown before the Massachusetts Horticultural Society which was the center of horticultural influence of the country. He raised many seedlings. *Thuya Hoveyi* is still prized as a garden conifer. His greatest contribution to horticultural varieties was the Hovey strawberry, which first fruited in 1836, and which is generally regarded as the starting-point of American commercial strawberry-growing. For many years this berry was the standard of market excellence (Fig. 1861). He continued to grow it and cherish it until the end. Mr. Hovey was long an active member, and for a time president, of the Massachusetts Horticultural Society. He was one of the active projectors

1883. Charles M. Hovey.

of the building which gave the Society a new and more commodious home.

A portrait of Mr. Hovey will be found in the first volume of the "Fruits of America." Another occurs in "Gardeners' Monthly" for 1886 (frontispiece) and "American Garden," November, 1887; and a reduction of this appears in Fig. 1883. L. H. B.

Hunnewell, Horatio Hollis (Fig. 1884), philanthropist and horticulturist, was born in Watertown, Massachusetts, July 27, 1810, and died in 1902 at Wellesley, Massachusetts. He was the eighth in line of descent from Roger Hunnewell, who came to this country from England in 1640. Hollis Hunnewell was educated at Harvard University and in Paris. At twenty-five years of age, he became a partner in the banking-house of Wells & Co., a Parisian bank for the accommodation of American tourists. He was later identified with the banking and railroad interests of the United States and many philanthropic movements, but the singular fact remains that he did not manifest a taste for arboriculture and horticulture, his favorite pastime, until he was over forty years of age. He was first to introduce the use of *Catalpa speciosa* for railroad ties, and hundreds of acres of catalpas were planted on the treeless plains along the lines of western railroads. Through his efforts, the first open-air exhibition of rhododendrons and azaleas was given in Boston in 1873. No previous attempt had been made in this country to bring together a large collection of these plants for landscape effect. The increased excellence and extent of arrangement of grouping of plants hitherto unused made him a landscape artist of first degree, and he gave a new impetus to American botany and horticulture. He was president of the Massachusetts Horticultural Society for 1875 and through his numberless benefactions helped to make horticulture a household word, not only in his beloved state, but throughout the country. G. B. Brackett.

1884. H. H. Hunnewell.

Husmann, George, grape-grower and author, was born at Meyenburg, near Bremen, Germany, November 4, 1827, and died at Napa, California, November 5, 1902. He came to the United States at an early age and was practically self-educated. His horticultural career began at Herman, Missouri, where he established the largest and oldest American vineyard that turned grapes into wine, with the exception of the Longworth vineyard in Ohio. He served with distinction in the Civil War, was a presidential elector in 1866, and was a member of the convention for revising the constitution of the state of Missouri. He established extensive nurseries and a model fruit farm that was the pride of the state, and the fruits and wines received first awards at all the fairs and expositions held at that time. In 1866, he published his first book, "Grapes and Wine." About 1869 he began the publication of the "Grape Culturist." In 1880 his second book, "Grape-growing and Wine-making," was published, and in 1888 "Grape-culture and Wine-making" was issued, and it became so popular that it was revised and published through four editions. He was president of the Bluffton Wine Company, Bluffton, Missouri, a member of the Board of Curators of the Missouri State University, a charter member of the Missouri State Horticultural Society and the Missouri State Board of Agriculture; professor of pomology and forestry, Missouri State University; a member of the Viticultural Congress that convened at Washington, D. C., and State Statistical Agent for the state of California. He was one of the first men to ship American phylloxera-resistant grape-vines to France to re-establish her vineyards. In coöperation with Parker Earle, he originated and helped to organize the Mississippi Valley Horticultural Society.

G. B. Brackett.

Jack, Mrs. Annie L. (Fig. 1885), was born in Northamptonshire, England, January 1, 1839, and died in February, 1912. Her maiden name was Annie L. Hayr. In 1852 she came to America and pursued her studies at a ladies' seminary in Troy, New York. She taught school at Chateauquay Basin, Quebec, about a dozen miles from Montreal, and later was married to Robert Jack of that place. Acting under her influence, their farm, known as "Hillside," was largely planted to small-fruits and vegetables, to which was in time added a greenhouse for floriculture. Thus were demonstrated the capabilities of that section for market-gardening, and others were led to follow the example so successful at the "Hillside" farm. But it was as a writer on horticultural subjects that Mrs. Jack is most widely known. Her "Garden Talks" and other contributions to the press have much value, being the product of her own practical experience. Her handbook entitled "The Canadian Garden" is of especial value to Canadian gardeners.

1885. Mrs. Annie L. Jack.

Linus Woolverton.

Jaeger, Herman, pioneer grape-grower of the Ozarks and grape-breeder, was born in Brugg, Switzerland, in 1844, and died in 1896. He went to Missouri in 1867 and settled at Neosho, where, until 1896, he lived and engaged in viticulture. In Europe he was trained as a viticulturist. At Neosho, in 1869, he planted a large vineyard. It was composed largely of Concord and other eastern types of grapes. In 1873 "blight" (probably downy mildew) destroyed his crop of grapes. In 1874 he began spraying to control this blight or mildew, using sulfur, iron sulfate and copper sulfate. He was undoubtedly the first to begin spraying for fungous diseases in this western section. This pioneer work in which he contemplated the use of fungicides, which became general with the introduction of bordeaux mixture a few years later, is an indication of his resourcefulness and his vision. The failure of eastern grapes to resist mildew turned his attention also to the native wild grapes of the Ozarks, which he observed to be resistant of disease. As a result, for a third of a century, he searched the Ozarks for promising wild forms. From these he originated many promising native seedlings and also crossed many of the latter with Concord and other eastern sorts. He advocated the use of the native post oak and summer grapes *Vitis Lincecumii* and *V. æstivalis* as the foundation stock upon which to build the future viticulture of the Ozarks. He originated upward of one hundred varieties worthy of trial in the neighborhood and many of his pioneer varieties have become the foundation stock upon which other

grape-breeders base their work. He also observed that the native Ozark grapes were free from the phylloxera which threatened the grapes of his native Europe. He was one of the first to make use of this observation by propagating millions of cuttings and sending them to Europe where they were used as resistant stocks upon which to graft European varieties.

He wrote but little and shrank from giving the results of his work before horticultural gatherings. He taught by personal contact and by results attained. His acquaintances, during his life regarded him as the leading grape-breeder and viticulturist of the Ozarks.

J. C. WHITTEN.

Kennicott, John A., doctor and pioneer horticulturist, was born in 1800 and died in 1863. When the greater part of Illinois was a wilderness of grass prairie and when Chicago was a straggling village, Dr. Kennicott was planting shade and ornamental trees at his home. He was a leading spirit in the organization of the Cook County Agricultural and Horticultural Society in 1856, and held the first successful fair in 1857 on forty acres that later held solid blocks of skyscrapers. This horticultural society was short-lived, but Dr. Kennicott did much to stir up the farmer and the fruit-grower to the possibilities wrappd up in horticulture in Illinois. He was a ready writer and a good talker; he was first president of the Northwestern Fruit-Growers' Association and president of the Illinois State Horticultural Society in 1861. Dr. Kennicott was well educated, painstaking and self-denying. He did much for Illinois horticulture and the present generation owes him a lasting debt of gratitude for his noble, far-reaching pioneer work in horticulture.

G. B. BRACKETT.

Kenrick, William, nurseryman and author, was born in 1795, and was the oldest son of John Kenrick, one of the pioneer American nurserymen. His father commenced his nursery in the year 1790 on Nonantum Hill, near the line of the towns of Newton and Brighton, Massachusetts, and on the very ground where the apostle Eliot began his labors for the Indians, under Waban, their chief. The raising of peach seedlings was the commencement of Mr. Kenrick's work. He soon acquired the art of budding, and thus offered named varieties for sale. In the year 1823 his son William became a partner in the nursery, and we find the first advertisement of the stock in the October number of the "New England Farmer" of that year. It named thirty varieties of finest budded peaches 5 to 8 feet high at 33⅓ cents each; ten varieties of European grapes; four American: Isabella, Catawba, Bland and Scuppernong; currants, horse-chestnut, catalpa, mountain-ash, lilacs, roses and a few other ornamental trees. It was stated that the trees would be packed with clay and mats. The son, William, appears to have assumed early control, having planted in 1823 two acres in currants alone. In 1824 they made 1,700 gallons of currant wine, increasing the amount to 3,000 gallons in 1825 and to 3,600 in 1826. Mr. Kenrick was an enthusiast in whatever he did, his extensive cultivation and introduction of the Lombardy poplar being an illustration of his sanguine temperament. A still more marked instance was his culture of the *Morus multicaulis* about the year 1835, and his advocacy of silk culture. For a time he found this to be a more profitable venture to himself than to his patrons. But it should be said that, however sanguine and confident were his opinions, they were honestly held and with no intent to mislead. In the year 1835, Mr. Kenrick published "The American Silk-Growers' Guide," a small treatise on mulberry-culture. In 1833 appeared the "New American Orchardist." This is a larger work, and is a full description of the fruits of that date. The author acknowledges his large indebtedness to other cultivators, especially to Mr. Robert Manning, of Salem, who published his "Book of Fruits" in 1838. Mr. Kenrick died in February, 1872.

WM. C. STRONG.

Kerr, Jonathan Williams, fruit-grower and nurseryman, was born in York County, Pennsylvania, in 1842. In 1867, after the Civil War, in which he was a Union soldier, he went to Maryland, where he made his home. Prior to his soldier's life, he had taught school. After more than fifty years devoted to horticulture, he died on July 31, 1913, of heart disease. Not only did he devote time to the growing of nursery stock for sale and of fruit for market, but spent much of his energies in the testing of new fruits and nuts to determine their value, especially in the Chesapeake Peninsula. He was one of the most diligent of watchers and students of nature as affected by art, his constant effort being to improve by cross-fertilization and selection those fruits, nuts and other plants that gave promise of being satisfactory either from the commercial or the amateur's standpoint.

This work involved an enormous amount of labor in collecting and trying out thousands of plum, apple, peach, and other fruit varieties, the plum receiving the lion's share of his study and effort. In this work, Mr. Kerr was perhaps the leading specialist in the development and improvement of our native plums. Whenever and wherever a variety of reputed superiority came to his attention he spared no pains or money to procure it and no efforts to give it a fair test. He passed careful judgment on more than 400 named varieties, the labor involved being as nothing compared to the pleasing and fascinating task he imposed upon himself. His farm at Denton, Maryland, was "a veritable little plum heaven" visited by other enthusiasts from all over the world.

Mr. Kerr also tested more than 400 varieties of apples collected with the object of ascertaining their adaptability to the peculiar conditions of the Chesapeake peninsula. The larger part of these were varieties of reputation established elsewhere, though many were comparatively new. He was also especially interested in nuts which could be grown in the peninsula—Persian and Japanese walnuts, chestnuts, chinquapins, filberts, pecans, and so on. At the time of his death, scores of experiments were still in process of completion.

At fruit-growers' meetings, more especially those of the Maryland State and the Peninsula Horticultural Societies, Mr. Kerr was one of the leading spirits. His intimacy with all branches of horticulture and his fluent speech combined with his dry humor and aptness of tongue made his remarks particularly pleasing, interesting and instructive. His writings are characterized by extreme conservatism and care.

M. G. KAINS.

Kirtland, Jared P., doctor, pomologist and naturalist, was born in Wallingford, Connecticut, November 10, 1793 and died near Cleveland, Ohio, December 11, 1877. His love for nature and all living things manifested itself in his early boyhood, and he was familiar with the flowers, the trees and the birds around his home. His grandfather bequeathed him his medical library and the funds for a medical education. He was the first student to matriculate at Yale College for a course in the Medical Department. No branch of scientific study came amiss to him. Prominent in medicine, he was in every chosen department of science a teacher and a leader. In the geologic survey of Ohio he brought to bear his extensive and familiar knowledge of the flora and fauna, the pomology, ornithology and entomology of the state. Every department of life received his particular care. He filled the chair of Theory and Practice in the Ohio Medical College for some years with great ability. As far back as 1810 he was studying the seedling pear trees in the nurseries in northern Ohio, and was trying to solve the

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perplexing problem of pear blight. He grew many varieties of pears and by a series of hybridizing produced many new varieties of pears and more than thirty new varieties of cherries; among the latter are the noted Governor Wood, Kirtland's Mary, Black Hawk, Pontiac, Powhatan, Tecumseh, Osceola and Red Jacket. The varieties were introduced by Ellwanger & Barry, of Rochester, New York. The Governor Wood and the Rockport are the two varieties of all the long list that are today most widely cultivated. In 1874 the Ohio Horticultural Society, in its session at Akron, sent a vote of thanks to Dr. Kirtland at Cleveland for his success and skill as a cultivator of new fruits. He was one of the most distinguished men ever connected with the Society. He replied that his highest aspiration in this matter was to awaken and develop a love for horticulture in the youth of the state. He had been actively engaged in the great work since July 4, 1812, and at the time of this meeting had not wearied of the well-doing for a period of sixty-two years! The hybrids of fruit gave him many new varieties of rare excellence. His flower-garden—always an object of interest—contained many specimens rare and beautiful, native and exotic. He succeeded in grafting the sweet bay on the magnolia and the rare flowers and fine fruits were his special care. He was a careful weather observer, and took accurate observations many years before the United States Weather Bureau charted the country.

G. B. BRACKETT.

Landreth, David, founder of the oldest seedhouse in America, was born in 1752 at Haggerston, Northumberland County, England. He came to America late in the eighteenth century, making Philadelphia his home, and establishing there, in 1784, a nursery and seed business. Its location, on what was then known as High Street, is now covered by the building 1210 and 1212 Market Street. The raising of trees and production of seeds were conducted on land nearby, particularly on a tract at Twelfth and Filbert streets. This locality proving too contracted for the purpose, the nursery and seed grounds were removed in 1789 to the "Neck," then considered far out of town, the place chosen being not far distant from the site of the present arsenal.

The younger David Landreth was born in Philadelphia in 1802. When of suitable age he entered actively into his father's business, which had considerably extended in Philadelphia, while a branch house had been opened in Charleston, South Carolina. The young man's early duty was that of manager of this Charleston branch. Of the Charleston business, it will suffice here to say that it continued till the era of the Civil War, when it came to a sudden end by the act of the Confederate States District Court, which confiscated the real estate and merchandise alike, on April 22, 1862.

BURNET LANDRETH.

Landreth, David, the younger, in 1828 succeeded his father as proprietor of the well-established and thriving business in Philadelphia, a business which was to remain highly prosperous for half a century afterward under his fostering care. His time, however, was not wholly occupied with the details of business, but was turned at an early age toward the literature of husbandry and to enterprises of public interest. Among the latter may be mentioned the Philadelphia Horticultural Society, of which, in 1827, he was one of the founders and a vice-president, and in 1828 was elected corresponding secretary, which office he held for seven years. At a subsequent date he was made president of the Philadelphia Society for the Promotion of Agriculture, and vice-president of the United States Agricultural Society, and became an active member of many other organizations.

His literary labors included the publication of the "Floral Magazine," started in 1832, and an advanced work for that period (see page 1559). At a later date he wrote much upon husbandry, his graceful style as a writer and his technical knowledge of the subject making his views of much value in the progress of the industry. He edited an American edition of George W. Johnson's "A Dictionary of Modern Gardening," a volume of 635 pages, published at Philadelphia in 1847.

In 1847 the Landreth nursery was removed to Bloomsdale, Bristol, Pennsylvania, where Mr. Landreth established what is believed to be the most complete seed-farm in the United States, and where he planted an arboretum which for years stood unequaled in this country in the development of its trees. He was an early breeder of the Channel Island cattle, then styled Alderneys, and was among the earliest manufacturers of mowing and reaping machinery. In 1872–3 he experimented in steam-plowing with a Scotch engine, and in the following year with an American engine. Subsequently, steam-digging and steam-chopping were experimented with at Bloomsdale, and many improvements produced in the machine-shop of that model farm. In early life he had lived amid the plantations of the Landreth nursery, one of the show places of Philadelphia—the site now marked by the Landreth School—and his virtues and character were those of one brought up in intimate contact with nature.

BURNET LANDRETH.

Legaux, Pierre (or *Peter*), an early vigneron, who made one of the first attempts to establish the wine-grape and to make wine in this country. From his plantation at Spring Mill, near Philadelphia, Dufour secured vines for the great experiment in Kentucky (see Bailey, "Evolution Native Fruits").

The following information about Legaux is taken from Samuel Gordon Smyth, in the "Philadelphia Press," September 10, 1899:

"At the close of the Revolution there appeared among the French colonists in Philadelphia a man of superior talents and reputation, a political refugee who sought the hospitable shores of America to escape the impending doom which afterward swept over France. Pierre Legaux belonged to an aristocratic family of ancient lineage in Lorraine. By the scanty light thrown upon his early personal history we have been able to learn that he was born and educated in Metz; had been a counsellor in the Parliament there; a patron of the arts and sciences, member of several foreign academies, besides enjoying the personal friendship, favor and confidence of his sovereign Louis XIV. Under the régime, Legaux had filled positions in the Government with honor and distinction. Prior to the time of his escape to America, he had been in the diplomatic service of the king at one of the French West Indian Islands, and it was while there, through the intrigue and malevolence of his official superior, that he was forced to fly Guadaloupe to save his life. We begin to hear of his presence among his compatriots of Philadelphia, about 1786. He was spoken of as distinguished for his culture, scientific accomplishments and gentility. Mingling with the best society and finding friends among the men who were shaping the destinies of the nation, Legaux allied himself with the foremost, partaking actively in public affairs and appearing with the dignitaries in the social functions which enlivened the metropolis of America. Citizen Legaux became a member of the American Philosophical Society in 1787, at a time when his doing so would indicate the close touch he had with the ablest men of the day. It was in February, 1786, when Pierre Legaux bought from Augustine Prevost, a fine plantation on the Schuykill River near Spring Mill. The property called 'Mt. Joy,' contained 206 acres.

"Noting the remarkable growth, productiveness and sweetness of the native grapes which thrived so luxuriantly on the warm banks of our forest-bordered rivers, and confident of a great destiny for this country in the

cultivation of the grape, he argued that these latitudes compared favorably with those of sunny France and Italy in climatic and physical conditions favorable to its introduction and development. With this aim before him, he proceeded to demonstrate his theories. Importing a lot of the best varieties of stocks from Europe, even from distant Africa, he began the growing of vines on his plantation in 1787. He set out several acres on the warm southern slopes of the farm and gave most careful attention to their propagation. He talked learnedly about them to those whom he met and impressed his views upon the large circle of friends who gathered about and watched the progress of his new venture. As we glance over the pages of the newspapers of a century ago and read columns of matter concerning the vineyard, one naturally wonders at its vast importance. In fact, the 'Letters of a Farmer,' the news of the Old World by the latest packet and events transpiring within the borders of the infant Republic seemed subordinate to the paramount interests of the viniculturists."

The Pennsylvania Wine Company was organized to take over the enterprise, the stockholders comprising prominent men of the time. But the venture fell on bad ways. Dissensions arose, and litigation followed. "The devoted but aged Legaux, humbled and chagrined, became like a hewer of wood and a drawer of water where once he had been a gentle and influential host. In these latter days, the Sheriff came and went,—for the property was saved to the family by John Righter, Legaux's son-in-law, who by dint of picking up the shares here and there and buying off the claimants and so on, kept the estate intact. But before this had been accomplished Pierre Legaux, harassed, disappointed, and even robbed by his malicious servants, annoyed by the petty persecutions of neighbors, misunderstood and maligned, finally succumbed to the combination, and the spirit of the once cultured and ambitious Frenchmen passed into eternity, September 25, 1827." He was buried at Barren Hill, Montgomery, Co., Pa.

Lewelling, Henderson, pioneer nurseryman, was born in Salem, North Carolina, April 25, 1809, of Welch ancestry. At an early date he removed to Ohio and there founded the town of Salem; he removed to Indiana in 1831, founded another Salem, and to Iowa, 1839, there founding the town of Salem, and being of a roving spirit and a horticultural turn of mind, he left Salem, Henry County, Iowa, April 1, 1847. He joined one of the first colonies of emigrants to cross the Rocky Mountains to Oregon, where he left to posterity the name of "Salem," now the capital of that great state. True to his native inclinations, he took with him on his long journey westward from Salem, Iowa, by wagon-box and ox-team, in carefully prepared soil, 700 trees, vines and shrubs, representing a large number of leading varieties of apples and pears, a few varieties of plums and cherries and one Isabella grape-vine and one gooseberry plant. His scheme to establish a nursery in the densely wooded Northwest was so bold as to be audacious and the trip by ox-team across the plains, on a hitherto untraveled route, was long and arduous. He was advised repeatedly that his undertaking was hopeless. The trip through dry, thirsty land and over lofty mountain ranges was accomplished about the first of October, and Mr. Lewelling arrived at the Dalles with most of the trees alive. From that point he proceeded by water route to the town of Milwaukee, where he established the first nursery in the Pacific Northwest. George Himes, historian of Oregon pioneer days says it is an unquestioned fact that no other importation made by the early settlers did so much to add to the wealth and income of the people of Oregon as did Henderson Lewelling's traveling nursery. Ralph Geer, also a pioneer of 1847, in later years said: "That load of trees contained health, wealth and comfort for the old pioneers of Oregon. It was the mother of all the orchards west of the Rocky Mountains, and gave Oregon a name and fame that she never would have had without it. That load of living trees brought more wealth to Oregon than any ship that ever entered the Columbia River." Henderson Lewelling removed to California in 1854 and lived quietly until the termination of his life, December 28, 1878.

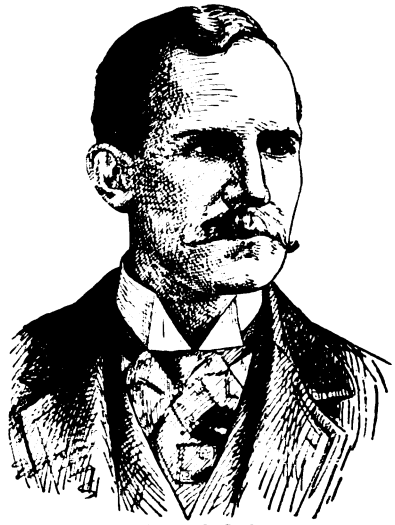
G. B. BRACKETT.

Lewelling, Seth, was born in South Carolina, March 6, 1819, and died at Milwaukee, Oregon, February 21, 1897. He was joint owner of an orchard on Cedar Creek, near Salem, Iowa, with his brother Henderson, and remained in charge of this orchard until 1850 when he crossed the plains to Oregon and became partner in the business of Lewelling & Meek, Milwaukee, Oregon. The nursery was not at first a success owing to the lack of stock on which to graft; but in 1850 seeds were brought to the territory by Mr. Pugh, and these were purchased by Lewelling & Meek and in 1851 they grafted 18,000 trees, and these apple trees sold readily for $1 apiece, and plum, cherry, pear and peach trees $1.50 each.

Seth Lewelling began his horticultural career with the beginning of the fruit industry in Oregon. He lived to see the pioneer cabins replaced by stately mansions; he lived to see the squatter claims become flourishing orchards and fruit-farms; he lived to see the populous East buy fruit from Oregon by trainloads and amounting to many millions of dollars; all this in fifty years. He was a horticulturist of the old school but he was not averse to teaching the younger men the road to success. He sold fruit in San Francisco in 1851 at $1 a pound, and it was then that the sister state of California realized that the gold in the mines was as nothing compared to the revenue she could reap from fruit orchards. She has steadily planted and is now the leading fruit-growing state in the Union. Mr. Lewelling was the originator of a number of fruits that have added materially to the wealth of Pacific coast horticulture; among these are the well-known Black Republican and Bing cherries and the Golden prune. He records the fact that he saw no fruit pests in Oregon until 1880; this is true of all new countries; insect pests and fruit diseases seem to follow colonization. Mr. Lewelling was a prominent figure in the fruit industry on the Coast, and he was one of the last survivors of the four pioneers who started the first orchards in Oregon.

G. B. BRACKETT.

Lodeman, Ernest Gustavus (Fig. 1886), horticultural investigator and writer, was born in Neufchâtel, Switzerland, May 3, 1867, and died December 2, 1896, when connected with Cornell University, Ithaca, New York. His parents came to America when he was two years old, his father becoming, in 1870, professor of modern languages in the State Normal School of Michigan. The son entered the Agricultural College of Michigan, where he graduated in 1889. Modest and lacking in self-assertion, he needed encouragement and stimulus to



1886. Ernest G. Lodeman.

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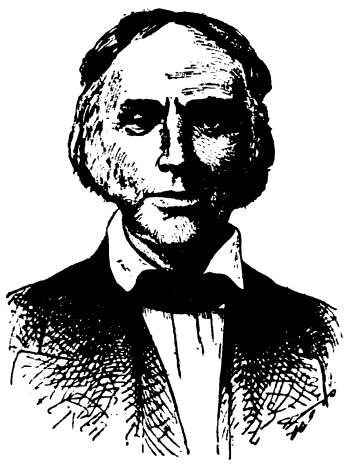
make a strong investigator and teacher. In a real estate venture in Florida, before his entering the Agricultural College, he became interested in agricultural problems and resolved to devote his life to them. In 1890 he undertook work as private assistant to the writer; and from this he became assistant and instructor in Cornell University. In the extension work amongst New York farmers he had charge of the investigations on grapes and strawberries. He was an originator of the spray-calendar idea. In 1896 he published "The Spraying of Plants," which is yet the fullest presentation of the subject. This was prepared after a most thorough traversing of the subject, both as author and experimenter, including a visit to Europe for the purpose of tracing the French history of the subject. He was an accomplished scholar, speaking German and French with fluency and possessing a working knowledge of other languages. His early death deprived American horticulture of a promising leader. L. H. B.

Longworth, Nicholas (Fig. 1887), (1783–1863) has been called the "father of American grape-culture." He was born in Newark, New Jersey. He early went to Cincinnati, then in the young and growing West, and engaged in banking and other business. He early became interested in agricultural affairs, and particularly in the grape. From John Adlum he received the Catawba, and became the means of making grape-growing a commercial success in the Ohio valley. He was a leader in the company of horticultural experts and writers which made Cincinnati famous in the middle of the century.



1887. Nicholas Longworth.

Longworth was one of the first to perceive that many strawberries are infertile with themselves, and to suggest the planting of pollinizers, although the imperfect nature of the strawberry blossom had been known long before his time. He also introduced the Ohio Everbearing raspberry, the first improved variety of *Rubus occidentalis*. Longworth was a pioneer of horticulture in the expanding West, and more than that he was a guiding spirit in horticultural affairs of national importance. In 1846 he published a pamphlet on "The Cultivation of the Grape, and Manufacture of Wine. Also, Character and Habits of the Strawberry Plant." He also contributed a chapter on the strawberry to Buchanan's "Culture of the Grape." For further notices, see Hovey's "Magazine of Horticulture" 29:160, and Bailey's "Evolution of Our Native Fruits." The portrait in Fig. 1887 shows Mr. Longworth at seventy-four years of age. L. H. B.

Lord, Orville Morell, horticulturist and plum specialist, was born in the town of China, Wyoming County, New York, April 20, 1826, and died at Minnesota City, Minnesota, July 21, 1906. The Lord family moved to Lapeer County, Michigan, in 1842. After two years' training at a private school in Pontiac, Mr. Lord taught public school for four years in the country near his home. In 1852 he moved west with his family to Minnesota and was one of the first settlers in the Rollingstone Valley near Winona where he lived till his death with the exception of the years from 1861 to 1864 when he returned to a farm near Kalamazoo, Michigan. He was a member of the Territorial Legislature of Minnesota in 1853–4 and served in the State Legislature in 1873–4. He was active in many lines of public service throughout his life. In 1884 he became a member of the State Horticultural Society of Minnesota and was elected an honorary life member in 1899. He conducted a sub-experiment station for the society at his home for many years. He was considered one of the leading authorities in the Northwest on all lines of horticulture and enjoyed a national reputation as a plum specialist. He cultivated the well-known "Rollingstone" plum from a wild variety growing in the Rollingstone Valley. He also established several varieties of very good hardy apples. Mr. Lord was a lecturer on horticulture in the Minnesota Farmers' Institute for a number of years and also horticultural editor of "Farm, Stock and Home." He always carried on an extensive correspondence with other horticulturists all over the country. E. G. Cheyney.

Lyman, Henry Martyn, pioneer horticulturist, was born at Easthampton, Massachusetts, September 13, 1828, and died at Excelsior, Minnesota, January 4, 1902. He was a descendant of Richard Lyman, who came to America in 1630 from England. Mr. Lyman received his education in the public schools and at Williston Seminary in Easthampton. His father died when he was fourteen years old and with the assistance of his mother and older brother he carried on the New England farm. Mr. Lyman came to Taylors Falls, Minnesota, in 1850. After remaining a year and a half, he returned to Massachusetts. In 1853 he came west again and landed at St. Anthony. He purchased an ox-team, a wagon and a little lumber and drove west to the site of the Lyman Homestead at Chanhassen, Carver County. He made this his home until his death in 1902.

Mr. Lyman was for years postmaster of one of the first post-offices in the county. He was interested in fruit-growing and planted the first apple trees in Carver County in 1853. These trees were not adapted to Minnesota and were winterkilled in 1856. In 1867 he planted more apple seed and from this lot came the "Lyman's Prolific" crab. From apple seed planted in 1876 and later came the Evelyn and other seedlings that are promising well for Minnesota conditions and are good keepers. Mr. Lyman was much interested in evergreens and early planted many varieties. He was one of the first settlers to realize their value as windbreaks and some excellent specimens are still to be found on the homestead.

In 1891 a trial station was located on his farm and is still in operation. He was treasurer of the State Horticultural Society in 1900. As a pioneer horticulturist, Mr. Lyman did very much to establish horticulture on a sound basis in Minnesota. Le Roy Cady.

Lyon, Theodatus Timothy (Fig. 1888), pomologist, was born in Lima, New York, January 13, 1813, and died in South Haven, Michigan, February 6, 1900. He was the son of a farmer. His school-going was very limited. In 1828, his parents went to the territory of Michigan, where he was employed in many pioneer pursuits, as farming, lumber-making, post-boy, tanner, merchant. He became more and more interested in farming, and in 1844 started a nursery on the farm at Plymouth, Michigan. He collected varieties from the local orchards, and found their names much confused. His interest was challenged, and gradually he became absorbed in a study of pomology, which in that day meant mostly knowledge of varieties. Articles on the varieties of Michigan apples in the "Michigan Farmer" attracted the attention of Charles Downing, and a correspondence and exchange of varieties resulted.

His name appears in the list of correspondents in the revised editions of Downing's "Fruits and Fruit Trees." For some years, Mr. Lyon was president of a railway company. In 1874, he moved to the "fruit-belt" of southwestern Michigan, where he became president of the Michigan Lake Shore Nursery Association, and where he lived until his death. The nursery association was not successful financially. In 1888, Mr. Lyon wrote a full (412 pages) and careful "History of Michigan Horticulture," which was published in the seventeenth report of the State Horticultural Society, a society of which he was president from 1876 to 1891, and honorary president until his death. In 1889, he took charge of the South Haven sub-station of the Michigan Experiment Station; and here, with his fruits and trees, he lived quietly and happily to the last.

1888. T. T. Lyon.

Mr. Lyon was one of the last of the older generation of pomologists. Like his colleagues, he was an expert on varieties. He was one of that sacred company which placed accuracy and cautiousness before every consideration of ambition or personal gain. His friends knew that he had not the temper of a commercial man. At one time it was said of him that he was the most critical and accurate of American pomologists. The fruit-lists of the Michigan Horticultural Society, his labors in revision of nomenclature for the American Pomological Society, and his various bulletins of the Michigan Experiment Station, show his keen judgment of varieties.

L. H. B.

McIntosh, John, originator of the McIntosh apple, was a farmer, born in 1777, near what is now known as the village of Dundela, in Matilda Township, Dundas County, Ontario, near the river St. Lawrence, and died in 1843. As a horticulturist he is noted only as the originator of the McIntosh apple. Little is known of his life, but the facts in connection with the McIntosh apple are as follows:

In 1796 he found growing in the clearing, a number of seedling apple trees. He took them home and planted fifteen or twenty of them in an orchard near his log house. One of these was named the McIntosh Red. The original tree lived until 1908. It was bearing apples until 1907, but its death was hastened by a hailstorm during that year. Ten years before it died it had been badly injured by a fire burning an adjacent building. The introduction of the McIntosh apple is mainly due to Allan McIntosh, the son of John, who was born in 1815 and died in 1899. He, during his long life, propagated and disseminated many trees, beginning the propagation in 1835. In 1912 a monument was erected on the old McIntosh homestead to commemorate the tree and its originator (see Vol. I, p. 317).

W. T. Macoun.

M'Mahon, Bernard (about 1775 to September 16, 1816), horticulturist, was born in Ireland and came to America, for political reasons, in 1796. He settled in Philadelphia, where he engaged in the seed and nursery business. He early began the collection and exportation of seeds of American plants. In 1804 he published a catalogue of such seeds, comprising about 1,000 species. He was the means of making many of our native plants known in Europe. He enjoyed the friendship of Jefferson and other distinguished men, and his seed store became a meeting-place of botanists and horticulturists He was interested in all branches of horticulture. It is thought that the Lewis & Clark expedition was planned at his house. At all events, M'Mahon and Landreth were instrumental in distributing the seeds which those explorers collected. In 1806, he gave to America its first great horticultural book, "American Gardener's Calendar" which was long a standard cyclopedic work. The editor of the eleventh edition of this book (1857) makes the following reminiscence of M'Mahon:

"Bernard M'Mahon was no common man. He sought the American shores from political motives, as is understood. but what these were has not been determined; most probably it was necessary to fly from the persecution of government. He found American gardening in its infancy, and immediately set himself vigorously to work to introduce a love of flowers and fruit. The writer well remembers his store, his garden and greenhouses. The latter were situated near the Germantown turnpike, between Philadelphia and Nicetown, whence emanated the rarer flowers and novelties, such as could be collected in the early part of the present century, and where were performed, to the astonishment of the amateurs of that day, successful feats of horticulture that were but too rarely imitated. His store was on Second Street, below Market, on the east side. Many must still be alive who recollect its bulk window, ornamented with tulip-glasses, a large pumpkin, and a basket or two of bulbous roots; behind the counter officiated Mrs. M'Mahon, with some considerable Irish accent, but a most amiable and excellent disposition, and withal, an able saleswoman. Mr. M'Mahon was also much in the store, putting up seeds for transmission to all parts of this country and Europe, writing his book, or attending to his correspondence, and in one corner was a shelf containing a few botanical or gardening books, for which there was then a very small demand; another contained the few garden implements, such as knives and trimming scissors; a barrel of peas and a bag of seedling potatoes, an onion receptacle, a few chairs, and the room partly lined with drawers containing seeds, constituted the apparent stock in trade of what was one of the greatest seed-stores then known in the Union, and where was transacted a considerable business for that day. Such a store would naturally attract the botanist as well as the gardener, and it was the frequent lounge of both classes, who ever found in the proprietors ready listeners, as well as conversers; in the latter particular they were rather remarkable, and here you would see Nuttall, Baldwin, Darlington, and other scientific men, who sought information or were ready to impart it."

M'Mahon's name was given to west-coast evergreen barberries by Nuttall in 1818, and these shrubs are still known as Mahonias. See pp. 1511, 1518, 1521.

L. H. B.

Manning, Jacob Warren, nurseryman, was born at Bedford, New Hampshire, February 20, 1826 and died at Reading, Massachusetts, September 16, 1904. Until the age of twenty-one, he remained on his father's farm. At that time he went to Chelmsford, where he was engaged in farm, fruit and nursery work. In 1849, he became superintendent of the Winnesemitt Nursery at Chelsea, of which the proprietor was S. W. Cole. He remained here less than a year and until June, 1854, he was employed as a gardener in Dorchester, Massachusetts, Burlington, and Brattleboro, Vermont. At that time, he moved to Reading, where he established a nursery in his own name. He introduced many large and small fruits and ornamental trees and shrubs, prominent among which are the Rocky Mountain blue spruce (*Picea pungens*), the Cutter seedling strawberry,

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the Dracut amber grape, the John Sweet and the Granite Beauty apple. Mr. Manning made a specialty of evergreens and also established a large department of hardy herbaceous plants. He was a member of the Massachusetts Horticultural Society and the American Pomological Society for over forty years. He was also a member of the American Nurserymen's Association, the Massachusetts Fruit-Growers' Association and others. He served on many fruit committees, making exhibits in various parts of the country.

Manning, Robert (July 18, 1784, to October 10, 1842), was one of the most thorough and accurate of American descriptive pomologists. In 1823 he established his "Pomological Garden" at Salem, Massachusetts, for the purpose of collecting and proving varieties of fruits. At the time of his death this garden contained more varieties of fruits than had ever been collected in America. Pears were his specialty, but he had all the fruits which would thrive in his climate. These fruits numbered nearly 2,000 varieties, of which about one-half were pears. These varieties were gathered from all parts of this country, and also from Europe. The new pears of Van Mons, the Flemish scientist and propounder of a theory of plant variation (see "Survival of the Unlike," Essay V), were introduced largely by him. He also received valuable acquisitions from Robert Thompson, of the fruit department of the London Horticultural Society. In 1838, Manning published at Salem his "Book of Fruits, being a descriptive catalogue of the most valuable varieties of the pear, apple, peach, plum and cherry for New England culture." It also contained bush-fruits, grapes and hardy trees and shrubs. It was published as "First Series for 1838," which indicates that its author intended to issue other parts. All the descriptions were drawn from the fruits themselves. The book was illustrated. In this work he was assisted by John M. Ives; and Ives made a second edition of the work in 1844 under the title "The New England Fruit Book," and a third in 1847 as "New England Book of Fruits." At this day it is difficult to appreciate the work of a man like Manning. In those days, varieties were all-important. The scientific management of orchards had not yet arisen. Varieties were confused. Manning and his compeers opened the way for correct nomenclature and systematic pomology, and established the idea of testing varieties. His decisions on nomenclature were accepted as final. He was one of the founders of the Massachusetts Horticultural Society. For a reference to the position of Manning's work in our history, see page 1522; also Tilton's "Journal of Horticulture," 7, pp. 157, 158.

L. H. B.

Manning, Robert, Jr., was born at Salem, Massachusetts on July 6, 1827, and died on February 17, 1902. He and his brother, Richard, succeeded their father in the work of the "Pomological Garden." In 1869, he was appointed editor of Tilton's "Journal of Horticulture," which position he held until this magazine was discontinued in 1871. He was Secretary of the Massachusetts Horticultural Society for twenty-six years. Under his editorship, the "History of the Massachusetts Horticultural Society" was completed in 1880. For a fuller account, see the "Cyclopedia of American Agriculture," Vol. IV, p. 594.

Meehan, Thomas (Fig. 1889), writer, editor, state botanist, vegetable biologist, legislator and nurseryman, was born in London, England, March 21, 1826. He died at Germantown, Philadelphia, November 19, 1901. His father, Edward Meehan, was head gardener for Col. Francis Vernon Harcourt, at St. Clare, near Ryde, Isle of Wight, and there Thomas spent his boyhood. He was self-educated, acquiring Latin, Greek, French and the elements of botany by studying at night.

Mr. Meehan's first published paper was at the age of twelve on the production of double-flowered stocks from single. His first scientific discovery published was on "The Sensitive Nature of the Stamens of the Portulaca," at fifteen years of age. At the same age, he produced St. Clare, the first hybrid fuchsia known to the horticultural world. Numerous scientific papers followed, resulting in his being elected member of the Royal Wernerian Society of Edinboro, without making application or the Society being aware that he was a boy. Thomas Meehan became a student at Kew Gardens, and after graduation came to America, landing on his twenty-second birthday. Here he was employed by Robert Buist, Sr., in Philadelphia; was superintendent of Bartram's Gardens, and later gardener to Caleb Cope, Holmesburg, and while there flowered the *Victoria Regia*, the second time blossomed in America. In 1853, he established Meehan's Nurseries, afterward famous for their fine collection of American trees. He was sole editor of the "Gardener's Monthly" for the thirty years of its life, beginning in 1859 (p. 1559). He founded "Meehan's Monthly" in 1891, which survived him. For sixteen years he was agricultural editor of "Forney's Weekly Press," and at one time was agricultural or horticultural editor or regular contributor to more than half a dozen weekly and monthly papers and magazines. For thirty years he was the regular scientific editorial contributor to the "New York Independent." He was appointed State Botanist by Governor Hoyt and held that position until his death. For many years he was a member of the Board of Visitors of Harvard University. He was a prolific contributor to the publications of the Academy of Natural Sciences of Philadelphia, of which institution he was senior vice-president for twenty-three years; to the proceedings of the American Association for the advancement of Science, of which he was one of the early Fellows, and to the American Philosophical Society, the Pennsylvania Horticultural Society, the Pennsylvania Agricultural Society, in all of which he was an active member. He was recognized as the leading vegetable biologist of his day. He was the originator of the doctrine of evolution that self-sacrifice plays as important a part in nature and evolution as the struggle for existence and the survival of the fittest. For his scientific attainments in horticulture he was awarded the Veitch medal by the Veitch Memorial Fund of England, the third American so honored. He was the author of "Native Flowers and Ferns of the United States."

1889. Thomas Meehan.

He was elected a member of the Common Council of Philadelphia in 1882, and was reëlected biennially thereafter as long as he lived. As councilman, he inaugurated a movement for numerous small parks in Philadelphia. He was a member of the Germantown school board for eighteen years, and during that period secured the establishment of seven new schools, two exclusively for colored teachers. Other of his activities that may be mentioned are as follows: He

discovered the Englemann Cañon in the Wasatch Mountains; in Alaska, he discovered the movements of plants in connection with the movements of glaciers; at the close of the war, he went South as a member of a committee to restore confidence and business relations between the two sections; he made what is supposed to be the first complete list of plants in Kew Gardens, over 1,600 plants being recorded; he was largely instrumental in the establishment of the Department of Forestry in Pennsylvania.

W. E. MEEHAN.
in Cyclo. Amer. Agric.

Miller, Samuel, pioneer plant-breeder, horticultural writer and plant-disseminator, was born at Lancaster, Pennsylvania, in 1820, and died at Bluffton, Missouri, in 1901. At Calmdale, Pennsylvania, he began the breeding of grapes, about the time of the introduction of the Concord. In 1867 he removed to Bluffton, Missouri. Here he brought together a notable collection of the various types and varieties of fruits and ornamentals. He did notable work in testing the adaptability of varieties to the central West, and his advice as to what sorts to plant in this section was sought by horticulturists, not only in Missouri but in surrounding states. Scores of plant-breeders sent him their new varieties to be tested, knowing that he would not only express a frank and honest opinion but that his judgment was sound, due to his extensive acquaintance with existing varieties. In addition to his work in introducing and testing varieties originated by others, he gave an important share of his time and energy to plant-breeding, most notably with grapes. No less than half a dozen varieties of his grapes have found a place in our pomological list, among them Martha, Black Hawk, Eva and Louise. He was an advocate of close breeding, for the reason, expressed by him, that his hybrids "broke up into many forms, giving uncertain results," while his close-bred seedlings, particularly of Concord and its descendants, "gave a large percentage of promising sorts." He originated the Captain Jack strawberry, which for two decades was largely used as a pollinator of Crescent in the berry fields of the West. During the later years of his life he was engaged in the amelioration of the native persimmon, of which he propagated a score of promising sorts, among them the Josephine.

For a third of a century Judge Miller was an officer of the Missouri State Horticultural Society, modestly declining to accept its presidency, often tendered him by its members. The annual reports of this organization contain many papers by Judge Miller. For a third of a century he also contributed regularly to the horticultural columns of "Coleman's Rural World." His writings are clear and sound. They were a distinct contribution to the horticulture of the author's generation.

J. C. WHITTEN.

Moon, James, and his descendants, have been of importance in the development of ornamental horticulture in America. Descended from English parentage, James Moon came to America in 1681 and purchased a tract of land near Morrisville. His grandson, also James Moon, took up a large tract in Bucks County, Pennsylvania, in 1749, and devoted a part of his time to the raising of fruit trees. Records of his transactions as early as 1769 are still in possession of the family, although no extended commercializing was attempted by any of the decendants until 1849, when Mahlon Moon purchased a tract near the Delaware River at Morrisville, Pennsylvania, and engaged in the nursery business, issuing his first catalogue in that year. With no desire for an extensive business, he laid substantial foundations for promoting a more general planting of ornamental trees and from the start largely specialized in these. He was the originator of the Numbo chestnut and introducer of *Exochorda grandiflora* and *Azalea amœna*, all of which he propagated very extensively. Mahlon Moon was born 1814 and died 1887.

Wm. H. Moon, oldest son of Mahlon Moon, was born in the nursery homestead of his father, Morrisville, Pennsylvania, 1849, and after completing his education continued for a time in the business of his father, but in 1872 established nurseries of his own in the same community, putting a strong spirit of commercialism into his business and from the first specializing in ornamental trees, especially in evergreens. He was probably one of the first persons to make a strong plea for more extensive use of this valuable class of trees and did more than any one man to promote new methods of culture and development into plants of individual merit and perfect outline. The business which he had thus started in a small way grew steadily through his persistent efforts until the time of his death in 1911. With his business activities Wm. H. Moon always found time to take a keen interest in affairs aside from his business. He was much interested in educational matters, giving his time and interest for their benefit. He was an active member of the Pennsylvania Horticultural Society and for seven years its president. In 1905 he was very active in founding the Pennsylvania Nurserymen's Association and was its first president. He was also a member of the National Nurserymen's Association and was one of the organizers of the Ornamental Growers' Association. His strong desire from the time of engaging in business was to put the utmost commercialism into horticulture and he was rewarded by the very extensive growth of his business.

Samuel C. Moon (1854–1911), the second son of Mahlon Moon, continued the nursery business established by his father. He was a thorough lover of horticulture and his trees were his friends, his home being surrounded with many rare specimens planted by his father or collected and established by his own hands. His main development was in the line of ornamental horticulture, of which he was a rare student, contributing frequently to literature on the subject and occasionally addressing audiences on plant life. He was an authority on evergreens. Samuel Moon devoted many years to the best welfare of his community. He was active in educational and religious work. At the time of his death Samuel Moon was president of the Pennsylvania Nurserymen's Association.

HENRY T. MOON.

Moore, Jacob, pomologist, was born at Brighton, New York, in 1836. His life-work was the development of new fruits, which he produced in large numbers by scientific plant-breeding. He was the originator of the Diploma currant, Red Cross currant, Hooker strawberry, Brighton, Diana-Hamburg and Moore's Diamond grapes, Barr Seckel pear and thousands of other fruits which have enriched the fruit-growers of America many thousands of dollars, but which brought him hardly a sufficient pittance to keep body and soul together. He also expended a competent private fortune in the work. He passed much of the late years of his life in trying to secure congressional legislation that would protect originators of fruit varieties, but his efforts were, unfortunately, without avail. Mr. Moore was a member of the Western New York Horticultural Society for nearly fifty years and was widely known among horticulturists. He died at Canandaigua, New York, in the winter of 1908.

G. B. BRACKETT.

Munson, Thomas Volney (Fig. 1890), nurseryman, grape-grower and author, was born September 26, 1843, near Astoria, Illinois, and died January 21, 1913. He received his education from the public schools of Illinois, the academy at Lewiston, Bryant-Stratton Business College and the University of Kentucky. In 1906 the University of Kentucky conferred upon him the degree of D.Sc. Dr. Munson located at Denison, Texas, where all his industrial, scientific and literary

work was done. He established one of the most famous vineyards in the South, besides building up a reliable and well-known nursery business. He was the acknowledged authority on the native wild grapes of North America, and Bulletin No. 3, Division of Pomology, United States Department of Agriculture, "Classification and Generic Synopsis of the Wild Grapes of North America," which he wrote and which was published in 1890, is one of the most painstaking pieces of botanical work ever done in this country. It made the way for his later and greater work on "Grape-Culture." His horticultural and scientific work in hybridizing and perfecting the American Vitis won for him a diploma from the French Government in 1888, and the decoration of the Legion of Honor with the title of Chevalier du Merit Agricole for the aid he had rendered France in viticultural matters. He was also a member of the American Academy of Science, the National Agricultural Association of France, vice-president of the American Pomological Society, member of the American Breeders' Association, the Association for the Advancement of Science, and vice-president of the Texas Horticultural Association. In 1903–4 he was a member of the Texas World's Fair Association and the chairman of the committee of Texas Industrial Institutes. He was also a member of the jury of awards at the St. Louis Exposition in 1904 and an honorary member of the American Wine-Growers' Association and also a vice-president of the Society for Horticultural Science.

The most complete botanical display of the whole grape genus ever made was prepared by Dr. Munson and exhibited at the World's Columbian Exposition, Chicago, in 1893. This collection, now in the United States Department of Agriculture, will ever be a striking record of his wonderful patience, painstaking care and skill. His splendid book "Foundations of American Grape-Culture" is regarded as the most practical, complete and satisfactory account of the American grape yet issued, and is a lasting monument of his zeal, energy and scientific investigation. He knew the philosopher's stone, and left a last message to mankind to the effect that each individual should strive to be as useful and as free from blemish as a tree or a flower.

1890. T. V. Munson.

G. B. Brackett.

Nelson, A., pomologist, was born in Oneida County, New York, September 8, 1830, and died at Lebanon, Missouri, November 10, 1901. His early years were spent on a farm, where he always took great interest in horticulture. In 1858, he moved to Buffalo, where he engaged in the grain and coal business. After twenty-five years residence in that city, he went to Lebanon, Missouri, as an agent of the Ozark Plateau Land Company. Mr. Nelson was a very enthusiastic horticulturist, and was particularly interested in apples, being an authority on the varieties. He contributed to all the great fruit exhibits of the state, and for many years was treasurer of the Missouri State Horticultural Society. For portrait, and a fuller account, see forty-fourth report of Missouri Horticultural Society, of 1901.

Newman, James Stanley (Fig. 1891), was born December 11, 1835, in Orange County, Virginia. He passed his early life on the farm, working under the direction of his father, a highly educated and skilful agriculturist. In a private home school he was prepared for the University of Virginia where he studied four years, 1855–9. He served as a Confederate soldier in the Thirteenth Virginia Regiment. From 1865 to 1875, he farmed and taught; from 1875 to 1883 he was connected with the Georgia State Department of Agriculture, preparing publications, collecting agricultural statistics, and directing experiments. For nine years, he was professor of agriculture and director of the experiment station of the Alabama Polytechnic Institute, and for three years president of the Alabama State Agricultural Society. For over twenty-five years he was a life member of the American Pomological Society.

1891. J. S. Newman.

When Clemson College, at the old farm home of Jno. C. Calhoun, was organized in the early nineties, Colonel Newman was elected professor of agriculture and director of the agricultural department of that institution. He resigned in 1894, and ran a truck farm near Atlanta until July, 1897, when he was called back to Clemson College, where he served as professor of agriculture and director of the agricultural department and vice-director of the South Carolina Experiment Station, and (for three years) director of farmers' institutes, until his resignation in July, 1905.

Colonel Newman was the author of "The Southern Gardener's Practical Manual" and of several other useful works on agriculture and live-stock.

The last five years of his life were passed, as he had often expressed a wish they might be, in his own home, amid the fruits and flowers he loved so well. He was widely known in the South Atlantic States as a pioneer in the cause of the new agricultural education and uplift. He died at Walhalla, South Carolina, May 11, 1910.

Wm. S. Morrison.

Olmsted, Frederick Law, landscape architect, was born April 26, 1822, at Hartford, Connecticut, and died August 28, 1903. He was educated in private schools, with private instructors in surveying and civil engineering. He was a special student at Yale College, a working student on crack farms, with seven years' farming on his own farms. He took several trips abroad for study of many parks and fine private places. He was superintendent and landscape architect of Central Park practically in partnership with Calvert Vaux, a young English architect who had been associated with Andrew Jackson Downing (in his time the leading landscape gardener of the United States) most of the time from 1857 to 1878. From 1865 to 1872, he was in partnership with Mr. Vaux and F. C. Withers, then alone, and later with various other partners. Some of his principal works were the parks of New York, Brooklyn, Buffalo, Chicago (South Parks), Milwaukee, Rochester, Louisville, Boston, Detroit, and many other cities and towns, the United States capitol grounds at Washington, World's Fair at Chicago, the great estate of George W. Vanderbilt at Biltmore, North Carolina, and the grounds of many public and semi-public institutions and of private individuals. He wrote a number

of standard books of travel and he did a large amount of technical writing, most of which is scattered in the files of park commissions and other public and semi-public boards, and in periodicals, encyclopedias, and reports to owners of private estates. While he was familiar with the architectural and engineering, arboricultural and horticultural branches of his profession, and often designed the minutest details, yet in general, it was his practice himself to evolve the general designs for works of landscape architecture and to direct partners, assistants, superintendents, engineers and gardeners, working intimately and sympathetically with him, in the elaboration of general plans, working drawings, specifications and in superintendence. In this way he was associated in design with scores of architects, engineers, landscape gardeners and other technical men so intimately that in many cases it would be impossible to distinguish where the work of his assistants began and his ended. In the execution of his ideas in landscape planting, for example, he was assisted in the work on Central Park by Ignaz A. Pilat, and during the second period of his employment by W. L. Fischer, who also worked under his direction on the Boston parks; on the Brooklyn parks by O. C. Bullard; on the Buffalo parks by William McMillan; on the United States Capitol grounds by William Cogan, and on many other parks, grounds of institutions and of private individuals by Warren H. Manning, and so on. Mr. Olmsted took the greatest interest in and secured the adoption of what may be called the naturalistic style of planting, confining the use of the architectural style of planting almost invariably to gardens in close connection with important public or semi-public buildings or private residences. He may fairly be said to have been the originator in this country of the extensive use of shrubbery borders and masses as a main feature of landscape planting instead of planting individual shrubs as mere decoration. His influence throughout the whole country has been very great, as shown by the adoption by a host of imitators of the irregular, informal, picturesque or naturalistic landscape style, with the prevalence of curvilinear roads, walks, and the like. Some of these imitators often applied this style where it was distinctly inappropriate and where the formal or architectural style should have prevailed, as in the grounds of several universities and other semi-public institutions having usually large buildings. For portrait and further details, see "Cyclopedia of American Agriculture," Vol. IV, p. 601. JOHN C. OLMSTED.

Parsons, Samuel B., nurseryman, landscape gardener and author, was born in New York City, February 14, 1819, and died at Flushing, New York, on January 4, 1906. In 1899, he established a nursery with his brother Robert at Flushing, giving special attention to the introduction and propagation of ornamental trees and shrubs. They were the first nursery firm to introduce the Japanese maples and also to propagate rhododendrons in the United States. Mr. Parsons was an expert landscape gardener and the author of numerous essays on this and related subjects. He was also the author of a book on "The Rose, its History, Poetry, Culture and Classification." He was a charter member of the American Pomological Society and an honorary member of the Massachusetts Horticultural Society from 1856. For a fuller account and portrait, see "Cyclopedia of American Agriculture," Vol. IV, p. 602.

Pettit, Murray, fruit-grower, was born on March 13, 1843, at Saltfleet, Ontario, Canada, and died at Winona on March 3, 1910. On reaching manhood, he engaged in farming, in 1872 taking up fruit-growing as a specialty. He first took up the growing of peaches, and later branched into the culture of apples, pears, plums and grapes. He was particularly distinguished as a grape specialist, and was one of the first to plant Niagara grapes in Ontario. He carried on a number of experiments with grapes and other fruits and in 1894 was appointed director of the Experimental Station at Winona, which office he held until his death. Mr. Pettit was always among the first to take up new ideas, and was the third man in Ontario to use the spray-pump. He was very active in all the local fruit-growers' societies and a member of the Ontario Fruit-Growers' Association, having at one time served that body as president for a period of two years.

Prescott, Charles Rammage (Fig. 1892), pomologist, was born of Loyalist parents in Lunenburg County, Nova Scotia, the latter part of the eighteenth century. He was a successful merchant for many years in Halifax, but in 1812 closed his business and moved to the Annapolis Valley near Wolfville, Kings County, where he bought a farm and developed a fine estate. The old house still stands in good repair, though the gardens, orchards and vineyards, once the pride of the province, have largely disappeared. The work for which he is especially remembered is the introduction and dissemination of choice varieties of fruits. He is credited, among apples, with the introduction of Ribston, Blenheim, Gravenstein, Baldwin, Rhode Island Greening and Northern Spy, six out of the ten leading commercial varieties of the province today. The list of his introductions among other fruits is almost equally important. He was very generous with cions from his trees, and many of the earlier orchards of the province can be traced directly to his influence. He died in the autumn of 1859. F. C. SEARS.

1892. Chas. R. Prescott.

Prince, William, the second proprietor of the Prince Nursery at Flushing, Long Island, was born about 1725 and died in 1802. The nursery, which was perhaps the first large commercial one in America, was established about 1730 by his father, Robert Prince.* The Huguenots who settled at New Rochelle and on the north shore of Long Island brought with them a variety of French fruits, and the interest thus created in horticulture resulted in the establishment of his first nursery. For a number of years attention was confined chiefly to the fruit trees with which to stock the new country, and it was only when more settled conditions came that the culture of ornamental trees and shrubs was introduced. Under William Prince, the nursery grew rapidly in importance until the Revolution. A return of peace brought with it increased trade, to make good the depredations of the soldiery as well as to restock the orchards of those who for seven years had paid more attention to the science of war than to the pursuits of horticulture; and a catalogue of 1794 contains as many varieties of fruit as those of some nurseries of the present, apricots and nectarines, for example, each being represented by ten varieties.

Not only was everything of merit imported, but the origination of new varieties by a careful selection of seedlings was enthusiastically conducted. Two plums, still well known, date from this period, Prince's Yellow

*The founding of the establishment is usually attributed to William Prince, rather than to his father Robert. Page 1517.

Gage being originated in 1783 and the Imperial Gage in 1794. The "Treatise on Horticulture" mentions that in 1790 no less than twenty-five quarts of Green Gage pits were planted, from which seedlings were obtained of every color and shape, it being probable that the Washington plum was originated in that year. Before the death of this William Prince, the nursery business had been taken up by his sons, William and Benjamin; the former on new ground, called the Linnean Botanic Garden and Nursery, the latter at the original place, called The Old American Nursery. L. B. PRINCE.

Prince, William, third proprietor of the Prince Nurseries at Flushing, was born November 10, 1766, and died April 9, 1842. During his lifetime, the Prince Nursery was one of the centers of horticultural and botanic interest in America, and reached the height of its fame. He continued the work of his father in the introduction of all foreign trees and plants of value, the discovery of unknown American species and the creation of new varieties from seed. One of the trees introduced to great popularity by William Prince was the Lombardy poplar. In 1793, he bought additional property of 80 acres at Flushing. For fully fifty years, the nursery was conducted much less for profit than from a love of horticulture and botany. It was designed to contain every known kind of tree, shrub, vine and plant known to England and America that possessed any horticultural merit. The catalogues from 1815 to 1850 ranked among the standard horticultural publications of the country. The number of varieties of fruits cultivated seems scarcely credible in these days, when many nurseries are conducted solely for profit, and only the trees or plants which find a ready sale are propagated. In 1828, Mr. Prince wrote and published the "Treatise on Horticulture," which was the first work of the kind produced in America. L. B. PRINCE.

Prince, William Robert (Fig. 1893), fourth proprietor of the Prince Nursery at Flushing, was born November 6, 1795, and died March 28, 1869. He inherited his father's love of botany and his great energy. He was connected with the American Institute, National Pomological Society, Massachusetts Horticultural Society, and many other important organizations, in whose transactions he took a prominent part. In 1830 he wrote, with the assistance of his father, the "Treatise on the Vine," a work of high importance. In 1831 he issued the "Pomological Manual" in two volumes, an important treatise on all fruits except apples. In 1846 he published the "Manual of Roses."

1893. Wm. Robert Prince.

In his early manhood, Mr. Prince botanized through the entire line of Atlantic States in company with Professor Torrey, of Columbia, and Professor Nuttall, of Harvard. The oldest cedar of Lebanon in the United States, as well as the oldest Chinese magnolias, salisburias, Mt. Atlas cedars, paulownias and purple beeches are to be found today in the grounds of the Prince homestead, together with many other unique specimens. When the disease of the Irish potato caused a fear that it would have to be replaced by some other vegetable, he imported the Chinese yam or potato (*Dioscorea Batatas*), paying $600 for the tubers. About the same time he introduced sorghum, or Chinese sugar-cane. He was unwearied in his endeavors to promote silk-culture in the United States. He imported not only the silk-worms but the mulberry trees to feed them, and built a large cocoonery for their accommodation. L. B. PRINCE.

Pringle, Cyrus Guernsey (Fig. 1894), plant-breeder and botanist, was born in Charlotte, Vermont, May 6, 1838; died in Burlington, Vermont, May 25, 1911. He early devoted himself to horticultural and botanical lines of study and work. In the late sixties, he converted the home farm into a nursery, specializing on hardy bulbs, and had growing at one time over one hundred species and varieties of Iris and nearly all known species of Lilium. From the more usual types of plant-culture, he turned to the then relatively new field of plant-breeding. He first worked with the potato, later with the cereals, garden vegetables and fruits. During the decade 1869–79, he devoted practically all his attention to this work with rare skill, insight, and success. Among his many productions the following are notable (see article by Wm. Stuart in "The Country Gentleman," June, 1905): Potatoes—Snowflake (Early Rose × Excelsior, introduced 1873), Alpha (Early Rose × Sebec, introduced 1874), Ruby (Early Rose × White Peachblow, introduced 1875), Trophy (Early Rose × Excelsior). Tomato—Conqueror. Wheats—Defiance (Gold Drop × White Hamburg, introduced 1877), Grandee (Little Club × Lost Nation), Champlain (Black Sea × Gold Drop, introduced 1879), Green Mountain, Pringle's Nos. 5 and 6: Oats—Pringle's Progress, Pringle's Hulless, American Wonder.

1894. Cyrus Guernsey Pringle.

He was at the same time training and inspiring others in this work and generously distributing his hybridized potato seed. This early work entitles him to a leading place among the pioneer plant-breeders in America, and he would no doubt have continued in this field and become one of its greatest leaders had not family griefs driven him from home. He then, following the advice of Asa Gray, turned to botanical explorations. He secured many of the specimens for the Jesup collection of North American woods in the American Museum of Natural History, New York City, the finest collection of its kind in existence, together with much of the field data on the distribution of the forest trees for the "United States Census Report" of 1880. He had previously begun collecting Vermont plants for Dr. Gray and soon achieved a world-wide reputation as the "prince of botanical collectors." His journeyings extended from northern New England into Canada,

across the Continent to the Pacific mountain regions and southward into Mexico. For twenty-six years, his work was chiefly in the latter country, continued under the patronage of the Mexican Government, the United States National Museum and other scientific institutions, and especially supported by Harvard University, on the botanical staff of which he was in 1893 appointed official collector by act of the Corporation. As a result of it, he not only enriched the leading herbaria of the world with extensive sets of choice specimens, especially of Mexican plants, but he amassed one of the largest and unquestionably the best private collections ever made. The Pringle Herbarium, of over 150,000 choice specimens, will remain his most fitting monument. During the last ten years of his life, he was Keeper of the Herbarium of the University of Vermont, and the Pringle Herbarium remains the property of that institution. L. R. JONES.

Purdy, A. M., horticulturist and author, was born in Macedon, Wayne County, New York, May 31, 1835, and died January 4, 1908. His father was a merchant in Macedon, but the son preferred outdoor life and in his boyhood was intensely interested in the raising of fruits and flowers. He was educated in the common school of Macedon Village, the Macedon-Center Academy, and at the Nine Partners Boarding School near Poughkeepsie, New York. In early manhood he went to South Bend, Indiana, where he engaged in growing fruits for about twelve years. Near the year 1865 he returned to New York state and purchased a farm on the Canandaigua road three miles south of Palmyra, and again engaged in growing fruits and nursery stock. On that farm over forty years of his life were spent, with the exception of three years' residence in Rochester. Soon after moving to New York State he began the publication of "The Fruit Record and Cottage-Gardener" and continued to issue the paper for over twenty-five years. He also published a small book entitled, "The Fruit Instructor." They were well received and many thousands sold. He also published as premiums three or four excellent fruit and flower chromos.

Mr. Purdy was a great worker, energetic, working early and late, and was a frequent contributor to agricultural and religious journals. He always took a great interest in politics and public affairs, and gave of his time and money for the advancement of the principles he thought to be right. He was a member of the Society of Friends (Quakers), and was recorded as one of their ministers. WM. W. MINER.

Ragan, Reuben, pioneer nurseryman and pomologist, was born in Louisa County, Virginia, on October 6, 1793, and died August 19, 1869. Left an orphan at an early age, he was indentured by the Orphan's Court to Elisha Thomas, a Shaker, but the indenture was soon revoked. He was then apprenticed to a tanner. Through his early association with Edward Darnaby, a nurseryman, Reuben became interested in horticulture and determined to devote his life to this pursuit. He established a nursery in Indiana in 1820, from which he disseminated many hardy varieties of fruit around the state. Mr. Ragan was a charter member of the Indiana Horticultural Society and a leader in the pomological work of the state. For portrait and fuller accounts, see "Report of Indiana State Horticultural Society," 1870.

Ragan, William Henry (Fig. 1895), nurseryman, horticulturist and pomologist, was born on March 29, 1836, in Putnam County, Indiana. His father obtained land from the government by entry in 1822, and was widely known as a pioneer nurseryman, fruit-grower and horticultural enthusiast. William Henry Ragan grew to young manhood amid the primitive conditions of pioneer days, helping his father in the nursery work and engaging in the usual pursuits of the farm boy. His formal education was all received at the local log schoolhouse of the district. About the year 1860, he engaged in the nursery and fruit business on land he purchased near Fillmore. From 1869 to 1871 he was in the fruit business in Indianapolis, having formed a partnership with John Wineberger of that city. In 1871 he moved to Clayton, Indiana, and continued in the nursery business with his cousin, W. A. Ragan, as partner. In 1881 he became a trustee of Purdue University. In 1883 he was appointed superintendent of the experimental station at the University and for a few months later in the same year acted as superintendent of the campus and weather station. He left Purdue University in 1884 to accept the chair of practical horticulture and the position of superintendent of parks at DePauw University, Greencastle, Indiana, which was in that year reorganized from the Indiana Asbury Academy. He had disposed of his nursery business on leaving Clayton and purchased property at Greencastle where he lived until 1899, leaving to accept a position in the Department of Agriculture at Washington. He became assistant pomologist and expert in pomological nomenclature in the Bureau of Plant Industry and won a world-wide reputation, not only for his wonderful work in nomenclature, but for his numerous other written contributions and for his personal services in the advancement of horticulture. He continued his work with the Bureau of Plant Industry until his death, which occurred in Washington, D. C., August 6, 1909.

1895. W. H. Ragan.

During his later years, William Henry Ragan was one of the foremost and best-loved figures among the horticulturists of the country. He was one of the founders of the Indiana Horticultural Society and continued his active membership until his death. He was secretary of this organization from 1869 to 1882 with the exception of 1873, and again from 1891 to 1895 inclusive. He became a trustee of Purdue University for the second time in 1888 and served until 1892. He was superintendent of the Division of Pomology at the Cotton Centennial at New Orleans in 1884–5 and served as secretary of the Committee on Awards in the Department of Horticulture at the Columbian Exposition at Chicago in 1893. He was secretary of the Mississippi Valley Horticultural Society in 1883–4 and, when the name of the organization was changed, continued the same work for the American Horticultural Society until 1888. From 1897 until his death he was chairman of the Committee on Revision of Catalogue of Fruits for the American Pomological Society. As a member of the Indiana State Board of Agriculture from 1873 until 1882, and as president in 1880, he did much to foster the cause of fruit-growing in his native state. C. G. WOODBURY.

Rand, Edward Sprague, lawyer and horticulturist, lost his life in the accident that befell the steamship "City of Columbus" in the early winter of 1884. Mr. Rand was for many years vice-president of the Massachusetts Horticultural Society. His exhibits of new and rare species of plants were of the best, and secured at considerable expense of time and money, an outlay he

made cheerfully for the good of horticulture. His collection of orchids was one of the largest and rarest of that time, and was donated to the Boston Botanic Garden. He was the legal counsel of the Massachusetts Horticultural Society, and an extremely prudent counsellor. To Mr. Rand's knowledge of books is due much of the success of the Society's excellent and voluminous library.

G. B. BRACKETT.

Rawson, Warren W., market-gardener, was born in Arlington, Massachusetts, January 23, 1847, and died August 9, 1908. He was educated in the schools of Arlington, Cotting Academy and Commercial College. He entered into partnership with his father in the market-gardening business in 1867, and in 1872 bought out the business, which he continued with success until his death. His plant is now the largest in New England devoted to market-gardening.

H. W. RAWSON.

Reasoner, Pliny Ford, florist, horticulturist and nurseryman, was born at Princeton, Illinois, May 6, 1863, and attended the common and high schools of his native town. He was very fond of plants when quite young and had the largest and finest garden in his neighborhood. He went to Florida in 1882, settled near Manatee, devoting his life to collecting and cultivating tropical and semi-tropical plants. Not long after reaching Florida, he was joined by his younger brother Egbert N. Reasoner, and together they established the Royal Palm Nurseries under the firm name of Reasoner Bros. He began an extensive correspondence in many languages with directors of botanic gardens and plant-lovers and -growers in various parts of the world, and he introduced many hundreds of tropical and semi-tropical exotics. These were tested in the nursery and sent out to plant-growers in general. He was horticultural commissioner in permanent charge of the sub-tropical exposition at Jacksonville, Florida, 1887-8, and one of the three Florida commissioners at the Cotton States Centennial Exposition at Atlanta in 1888. He died at Manatee of yellow fever September 17, 1888, at the age of 25. At the time of his death, he was gathering together materials and notes with the intention of writing a great encyclopedia of tropical horticulture and floriculture. He had a genial, kindly disposition and his intense enthusiasm for the cultivation of plants was contagious. His plant importations may be found scattered all over the lower South in all the extensive collections of that region.

CHAS. T. SIMPSON.

Rock, John (Fig. 1896), nurseryman, was born in Germany in 1836 and died August 8, 1904. His name was Johann Fels, which he translated into English on coming to America at the age of 15. He began in New York at once, at the bottom of the florist and seedsman business and rose slowly until 1861 when he volunteered (5th New York Zouaves) and fought till the close of the Civil War. Returning to horticulture, he settled in California in 1866 and built up one of the best and largest nurseries in the United States. He went to Europe many times, was in touch with nurserymen, botanists, horticulturists, all over the world, had extensive experiment grounds, tested thousands of new things, originated or brought into notice innumerable varieties of worth and at the time of his death, had 500 acres in nursery, at Niles, California. John Rock's scientific spirit, his wide and ever-increasing knowledge, his very high standards of business and his unselfishness made him during his long life the leader of Pacific coast nurserymen. He introduced more valuable plants and varieties to American horticulture than any other man of his period. His connection with Japan, India, Australia and with the great establishments abroad was close and constant. He did much to encourage men like Luther Burbank, and his collections were always at the service of students and the public.

1896. John Rock.

C. H. SHINN.

Roeding, Frederick Christian, nurseryman, was born in Hamburg, Germany, on December 31, 1824, and died July 18, 1910. His boyhood and early training were passed in Germany which fitted him for the successful commercial career which he subsequently achieved. He went to Chile and Peru in 1846. Three years later he left for California where he first went in for mining, but he soon abandoned this and became a member of the firm of Larco & Co., which afterward became known as the firm of R. Feurstein & Co., of which he was the senior member. He re-organized, and was one of the prime movers of the German Savings and Loan Society of San Francisco, and was vice-president and cashier for a period of twenty-five years. As early as 1869, his far-seeing judgment in the future of California's basic industry led him, with a number of other German associates, to buy 80,000 acres of land in Fresno County in the San Joaquin Valley. Shortly after this body of land was acquired, two sections, 1,280 acres, was deeded to the Southern Pacific Railroad Company for a town-site, by him and his associates, and it was on part of this land which comprises the best business and residential section of Fresno City today.

It was not until 1883 that he became actively engaged in horticultural work. It was in that year that the Fancher Creek Nursery was established. Possibly the chief event associated with his name is in connection with his work in the introduction of the Smyrna fig in California in 1886, and his untiring efforts in proving the necessity for caprification of this fig in order to produce it successfully. The first Smyrna figs, now known as Calimyrna, were produced through artificial pollenization in 1890, but it was not until 1901 that the first commercial product consisting of thirteen tons was placed on the market as a result of the pollenization of the little fig wasp, *Blastophaga grossorum*, which was imported the year previous with the assistance of the United States Department of Agriculture and established in some Capri fig trees on the Roeding place.

His name will always be associated with the City of Fresno, through his donation in 1903 of a piece of land for park purposes known as Roeding Park, consisting of 117 acres of ground in the immediate vicinity of the town.

GEORGE C. ROEDING.

Rogers, Edward Staniford, grape-hybridizer, was born in Salem, Massachusetts, June 26, 1826, and died in Peabody, Massachusetts, March 29, 1890. He was the originator of forty-five seedling grapes known as the Rogers' hybrids. He was the first man to recognize the possibility of the probable value of *V. Labrusca* × *V. vinifera* hybrid varieties. For the female plant he used Carter or Mammoth Globe and fertilized with Black Hamburg and White Chasselas from an adjacent cold grapery; this work was accomplished in the summer of 1851, and the clusters were carefully inclosed in sacks. As a result of these pollinations, he secured about

150 seeds, which he planted in an old garden at Salem. He succeeded in fruiting forty-five seedlings, of which one to five were of Carter Black Hamburg; six to fourteen were Carter × White Chasselas; and the numbers fifteen to forty-five were of Hamburg parentage. In 1858 Mr. Rogers sent these varieties, under original numbers to various sections of the country for testing. He lacked room for a fair test in his small garden; the dissemination led to confusion, and the nurserymen to this day have never gotten the matter straightened out, so far as mere numbers are concerned. Mr. Rogers then gave the most promising varieties names, and these names were selected for persons noted for literary or scientific attainments or else for the towns and counties in his native state. Leading horticulturists of the day thought all the varieties should be named, as they possessed equal merit to a remarkable degree; but Mr. Rogers' preferred list is as follows: No. 1, Goethe; No. 3, Massasoit; No. 4, Wilder; No. 9, Lindley; No. 14, Gaertner; No. 15, Agawam; No. 19, Merrimac; No. 28, Requa; No. 39, Amini; No. 41, Essex; No. 43, Barry; No. 44, Herbert; No. 53, or No. 22, Salem, but not the Salem of the present day. There was a meritorious standard of excellence about these hybrids that Mr. Rogers was unable to obtain with subsequent crosses. These hybrids brought about a new era in grape-culture, and while not so intrinsically valuable as some later varieties, the work of Mr. Rogers, in one way and another, has added millions of dollars to the grape industry of America.

G. B. BRACKETT.

Sargent, Henry Winthrop (Fig. 1897), a son of Henry Sargent, an artist of reputation in his time and a grandson of Daniel Sargent, a Boston merchant of a prominent Massachusetts family, was born in Boston in 1810. Graduating from Harvard in 1830, Mr. Sargent studied law, which he never practised, and in 1841 purchased a small estate on the plateau above Fishkill Landing, New York, overlooking the Hudson River. Inspired and instructed by his neighbor, A. J. Downing, the landscape gardener, then at the height of his brilliant career, Mr. Sargent began to lay out a garden. This soon became distinguished for its beautiful distant views and vistas obtained by the removal of some of the native trees which originally covered it, for the arrangement of the shrubberies which made a piece of ground of only twenty-two acres in extent appear like a large park, and for the collection of conifers in which Mr. Sargent was particularly interested and which in its day was the most complete in the United States. Mr. Sargent traveled extensively in Europe for the purpose of studying the arrangement of country places, and to secure plants for his collections. As one of the results of these journeys he published "Skeleton Tours," a guide to the most interesting estates and gardens in England, with directions how to reach them and what to see in each. To the sixth edition of A. J. Downing's "Theory and Practice of Landscape-gardening," published in 1859, Sargent added an important supplement in which he described the making of Wodenethe, the name of his own place, and the estate in Wellesley, Massachusetts, of his relative, H. H. Hunnewell, to which was added an account of the many new trees and other plants which had first been tested in this country at Wodenethe; and for the seventh edition, published in 1865, he extended this supplement to include descriptions of the most recently introduced trees. For many years and during the life of its genial, accomplished and hospitable owner, Wodenethe was one of the best-known country places in the United States, and its influence in teaching correct principles of the art of garden-making and in increasing the love of country-life in the United States and the knowledge of trees was great and of lasting value. Mr. Sargent died at Wodenethe in 1882.

1897. H. W. Sargent.

C. S. SARGENT.

Saul, John, nurseryman, was born at Castle Martyr, County Cork, Ireland, on Christmas Day, 1819, and died in Washington, D. C. on May 11, 1897. As he grew up, he was trained in the science of landscape gardening, and soon after becoming of age removed to the Isle of Wight, and subsequently to Bristol, England, in which place he was manager of extensive nurseries. Mr. Saul arrived in Washington in May, 1851, and was at once engaged by the Government to lay out the Smithsonian Grounds, Lafayette Square and other public squares, and also by W. W. Corcoran to plan the beautifying of Harewood Park. In 1852 he bought the property in which he spent the remainder of his life, 120 acres of which he set out in nursery stock, all kinds of evergreens, fruit, shade and ornamental trees and shrubs. He imported all new varieties from Europe as soon as they appeared. He equipped twenty greenhouses with large stock of new and rare plants, orchids and the like. He imported new plants from Europe as soon as they were offered for sale, and orchids from Africa, Mexico, Central and South America. He shipped plants to all parts of the country and some native plants to Europe.

He was appointed a member of the Parking Commission by Gov. Alexander R. Shepherd, and was reappointed by the District Commissioners after the office of governor was abolished, and was continued in office by each succeeding Board until his death, serving as chairman of the commission until the last.

B. F. SAUL.

Saunders, William, nurseryman, landscape gardener and horticulturist, was born in St. Andrews, Scotland, in 1822, and died in Washington, D. C., September 11, 1900. He was educated in Scotland and England and spent some years in practical horticultural training at Kew Gardens. He came to America about the same time as Wm. R. Smith, former Superintendent of United States Botanic Gardens, 1848. He wrote many practical and timely articles on horticulture and kindred topics for the "Gardener's Monthly," "Hovey's Magazine," the "Horticulturist" and other periodicals. In 1854 Mr. Saunders entered into partnership in the nursery business, general horticulture and landscape gardening, with the late Thomas Meehan of Philadelphia. While there he originated and introduced fixed roofs for greenhouses which marked a great improvement over the movable sash formerly employed. He was a landscape gardener of note, and finished the planting of some of the national capital's park system which had been previously begun by Andrew Downing. He planned many parks through the eastern portion of the United States, among the most noted of which were Clifton, the country home of the late Johns Hopkins at Baltimore; Rose Hill Cemetery, Chicago; Oak Ridge Cemetery, Springfield, Illinois, and the National Cemetery, Gettysburg, Pennsylvania.

In 1862 Commissioner Newton appointed Mr. Saunders the Botanist and Superintendent of Horticulture of the newly created Department of Agriculture at Washington, D. C. The Department was at first called a Bureau and did not become a cabinet office

until 1889. Mr. Saunders aided materially with advice and good work in shaping and developing the Department of Agriculture, and he was one of the ablest and most influential men the Department has ever had. He was one of the seven founders of the order of Patrons of Husbandry in 1867, and wrote its preamble and constitution. He was Master of the National Grange during the first six years of its existence.

He introduced into this country many fruits of economic importance. His knowledge of the flora of the world was extraordinary. He was one of the first to direct public attention to the proper environment for fruits; southern fruits for southern states, northern fruits for northern states. He introduced the hardy Russian apples for the extreme North in 1870. Mr. Saunders imported economic plants and trees of various kinds from almost every part of the globe. The *Poncirus trifoliata*, widely grown as a hardy stock for citrous fruits in the South and West, was obtained by him in 1869. He was endeavoring to secure a hardy type of Japanese orange, and the trees froze in transit from San Francisco to Washington, but the stocks survived, and these proved to be the now well-known *P. trifoliata*. He enlisted the aid of the late Prof. P. J. Berckmans of Augusta, Georgia, in the work of saving and perpetuating this stock. Mr. Saunders introduced the kaki or Japanese persimmon into this country and disseminated it widely in the South. His greatest success, however, was the introduction of the Bahia or Washington Navel orange, the seedless orange from Brazil that practically revolutionized the orange industry in California at that time, and brought in a subsequent revenue of millions of dollars.

G. B. BRACKETT.

Saunders, William (Fig. 1898), economic entomologist, horticulturist and the founder, and for quarter of a century Director, of the Experimental Farms of the Dominion of Canada, was born in England in 1835, and died in London, Ontario, September 13, 1914. He came with his parents to Canada when a boy of twelve. He started in business as a chemist and druggist and, as years went by, prospered to such an extent that he was able to devote his spare time and means to his favorite pursuits of botany, entomology and horticulture. He was one of the founders of the Entomological Society of Ontario, editor of the "Canadian Entomologist" for thirteen years, and author of the standard work, "Insects Injurious to Fruits," which is regarded as a classic by economic entomologists and fruit-growers.

Deeply interested in horticulture, he established a fruit-farm near London, and began his experiments in hybridizing and originating new varieties. His earliest efforts were devoted to the production of improved kinds of small-fruits, and he succeeded in obtaining satisfactory results with gooseberries, currants, raspberries and grapes, and also with roses and other ornamental shrubs. Many of his varieties are widely known and extensively cultivated, and his Emerald grape was considered the best of the Canadian sorts at the Colonial Exhibition in 1886. During this period he was an enthusiastic member of the Ontario Fruit-Growers' Association, which he was largely instrumental in maintaining during its day of small things, and of which he was president for some years.

In 1886 he was appointed Director of the Experimental Farms, and by his untiring energy, remarkable administrative ability, wide knowledge, both scientific and practical, long business experience and agreeable personality, he succeeded in establishing the chain of stations in all the provinces of Canada from the Atlantic to the Pacific, and prescribing for each its sphere of work in adaptation to its climate and local conditions. The immense value of the results obtained cannot be over-estimated; they will long continue to sustain the reputation of this man of genius to whose energy and ability they were due.

Among the many aspects of work which claimed his attention, horticulture continued to have a foremost place. For a long series of years Dr. Saunders carried on hybridizing experiments in order to produce apples hardy enough to withstand the rigors of the north-western provinces, and of good size and quality. Taking the wild Siberian crab, which grows freely in Saskatchewan, as the female parent and crossing it with the hardiest Canadian and Russian apples, he gradually succeeded in obtaining hardy varieties nearly 2 inches in diameter which thrive in the far North and withstand a temperature of even 60° below zero. His efforts with cereals were equally successful; his Marquis wheat has proved to be the best variety in all respects of those grown in the western provinces, and has added millions of dollars to the value of their farm products.

1898. William Saunders.

C. J. S. BETHUNE.

Sharp, Francis Peabody, the leading pioneer pomologist of New Brunswick, and perhaps of Canada, was born at Northampton, New Brunswick, in 1825, and removed to Upper Woodstock in 1844, at which place he resided until his death in 1903. Practically all of this time he was engaged in commercial orcharding, the growing of nursery stock, the testing of varieties and the creation of new fruits. He was the first man to introduce most of the standard varieties in the province—this being prior to 1858; obtaining cions from Canada, the United States and England. He devoted many years toward the production of varieties specially adapted to the New Brunswick climate and soil, the necessity of which he always emphasized. He early recognized the possibility of obtaining new and improved varieties from seed, and he imported seed from many sources for testing. In this manner he originated Sharp's New Brunswick apple, which many have regarded as being the Duchess of Oldenburg. Later, Sharp started to produce better varieties by hybridizing. Using the New Brunswick as one parent in most cases, he made upward of 2,000 crosses, originating a number of varieties of proved local worth, of which the best known is the Crimson Beauty. The date of the starting of this work does not seem to be definitely known but appears to have been about 1866. In an address given before the Farmers' and Dairymen's Association at Fredericton in 1896, Sharp stated that he and Peter M. Gideon were the first two men in America scientifically to hybridize the apple and pear. It would appear from this that Sharp was by many years the first man to begin this important work in Canada. Photographs and particulars are given in the report of the New Brunswick Fruit-Growers' Association for 1911.

A. G. TURNEY.

Shaw, Henry (Fig. 1899), founder of the Missouri Botanical Garden, popularly known as "Shaw's Gardens," was born at Sheffield, England, July 24, 1800, and died at St. Louis, Missouri, August 25, 1889. He came to the United States in 1819 and engaged in the hardware business until 1840 in St. Louis, where he continued to reside until his death. After retirement

from active business he traveled for a number of years, and in 1849 laid out a modest garden about his country house in the suburbs of St. Louis, which, nine years later, he extended so as to include some forty-five acres, about half of this area constituting an arboretum.

By special act of the General Assembly of the state of Missouri, approved in March, 1859, Mr. Shaw was empowered to provide for the conveyance of his property, either during his life or after his demise, to trustees, for the perpetual maintenance of his garden as a scientific establishment. In 1885 he endowed a department in Washington University, known as the Henry Shaw School of Botany, and on his death left nearly all of his property, valued at some $5,000,000, to a board of trustees for the maintenance, improvement, and enlargement of the Missouri Botanical Garden.

Mr. Shaw, though not a botanist, was a lover of plants for themselves and a firm believer in their influence in molding desirable traits in human character. His garden was always open to visitors, among whom he particularly welcomed the self-respecting poor. Thirty years before his death he gave to the city of St. Louis a park site adjacent to his garden, which, like the latter, was improved under his personal supervision.

1899. Henry Shaw.

Special provisions in Mr. Shaw's will, aside from the general arrangements for the development of the garden—in details of which he allows his trustees a very free hand—are for an annual sermon "on the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom;" premiums for an annual flower show; and two annual banquets, respectively for the trustees and gardeners of the institution. These banquets are the occasion for annual gatherings of men distinguished in botany and horticulture. See Vol. I, p. 531. WM. TRELEASE.

Shepherd, Robert Ward, horticulturist, was born in 1848 and died at Montreal in November, 1912. For nearly forty years Mr. Shepherd was closely and prominently associated with the development of horticulture in the province of Quebec. Although he was for many years connected with the Ottawa River Navigation Company, his great love for horticulture was always evident and early in his life he planted extensive orchards at his home at Como on the Lake of the Two Mountains. His specialty was apples and he grew most of the varieties recommended for the province of Quebec and was continuously testing new sorts. His favorite variety was the Fameuse and he developed a high-class trade with this variety in England, shipping the fruit in special compartment cases. He unceasingly advocated the planting of Fameuse in the province of Quebec in preference to any other variety on account of its high quality. He originated the Rochelle apple, a promising hardy variety. As early as 1877 he was a director of the Montreal Horticultural Society and when the Quebec Pomological Society was formed in 1893 he was one of the most active in its organization. He was president of this Society in 1895 and again in 1906 and a director for many years, and on many occasions prepared papers for the meetings. He was Fruit Commissioner for the province of Quebec at the World's Fair in Chicago in 1893, and on three occasions was one of those who represented the province of Quebec at Dominion Fruit Conferences. Because of his prominence as a fruit-grower and his enthusiasm, he was on many other occasions appointed on important horticultural committees. W. T. MACOUN.

Shepherd, Mrs. Theodosia B., and her husband were among the pioneers who left their homes in the Middle West to settle in California in the year 1873. Mr. Shepherd was an attorney and in this new country found little use for his services. His wife rose to the emergency and being of an artistic temperament, manufactured works of art out of the fauna and flora which she had collected. Her descriptive writings of flowers are among the finest this country has produced. The encouragement of Peter Henderson was incident to her entering this field. In 1881, she sent him a package of curiosities among which were a few choice flower seeds grown in the open. He wrote back saying that he believed California would be the great seed- and bulb-producing country of the world and that the conditions were ideal. Some of the products of her labor are a class of shrubby begonias of unequal vigor; a tea rose called "Oriole;" the perfection of cosmos; nasturtiums, California poppies and others were increased in size and beauty; the evolution of the petunia from a small flower of dull color to those of mammoth size and beautiful color. Mrs. Shepherd died September 6, 1906.

Shinn, James, pioneer nurseryman, was born at Salem, Ohio, September 29, 1807, and died October 29, 1896. He lived in several western and southern states and moved to California (from Texas) in 1855, establishing an orchard and nursery at Niles. He had studied and practised horticulture, had kept up a correspondence with specialists and at once took rank among the best-equipped men of the Pacific coast in his line of work. His introductions of Persian walnuts, Smyrna figs, Japanese plums and persimmons, the carob, Uinshiu oranges and many ornamentals were widely useful in the West and in the South as well as in California. His correspondence, and his newspaper writings, were extensive; he helped to found, and led in, the State Horticultural Society; his trials of new fruits and plants were extensive and thorough, and his coöperation with the experiment stations and with agricultural education was active. For more than forty years his influence broadened over the entire Pacific coast region. He was, with the exception perhaps of John Rock, the best known of California nurserymen. C. H. SHINN.

Smith, Andrew Murray, nurseryman, was born in Brandon, Vermont, September 24, 1832. The family removed to western New York in 1844, where Andrew made the best of his rather brief opportunities at a district school, and at Yabes Academy, Lockport. In 1852 Andrew engaged in work for Mr. E. Moody, near Lockport, and thus became acquainted with the nursery business, in which he afterward associated himself with Charles E. Woolverton, of Grimsby, Ontario, under the title of Woolverton & Smith. Finding a few old peach trees still bearing fruit in the garden of Dennis Woolverton about the year 1857, the firm decided to plant an orchard of six hundred trees, in addition to their nursery stock. The venture proved so successful that farmers about followed their example to such an extent that this Niagara District is now known as the "Peach Garden of Ontario." Mr. Smith continued the nursery business at Grimsby, Niagara and St. Catharines until the year 1900, when he retired at the age of seventy. He was one of the first members of the Fruit-Growers' Association of Ontario which was formed in 1859 and continued his active membership until his decease at St. Catharines, Ontario, October

19, 1910. For ten years, Mr. Smith was a director of the Association, of which he was made president in 1889, and a life member in 1900. No man in Canada has done more initiatory work in the development of the fruit industry of the province than A. M. Smith, insomuch that he has been called "the father of the commercial peach industry of Ontario." LINUS WOOLVERTON.

Smith, William Robertson, botanist, bibliographer, horticulturist, philanthropist, was born at the village of Athelstaneford, East Lothian, Scotland, March 21, 1828, and died July 7, 1912. He was educated in the schools of his native village. His earliest practical work in horticulture was done on the grounds belonging to the Earl of Wemyss, and later at Airthrie Castle and still later at Kew Gardens. On coming to America he located in Philadelphia, but was soon called to take charge of the work of the United States Botanic Gardens. These Gardens, nestling at the foot of the Capitol of the United States, were conceived by George Washington and are all that remains of his grand scheme of a national college and a national church. In 1822 a Botanical Society was formed and some planting was done on the drier portion of the marshy reservation. This society published what is now a very rare book entitled "Prodomus Columbiana," and it contained a list of the plants then in the District of Columbia. To this collection, John D. Breckenridge, prominent botanist of his day, added large quantities of plants of interest. The plants secured by the Wilkes' expedition around the world, placed in the Patent Office conservatory, were consigned to the United States Botanic Gardens in 1850 and Mr. Breckenridge was employed to give them expert attention, and with him was associated Dr. Asa Gray, botanist. All expenditures for the Gardens from 1851 to 1854 were paid from funds accredited to the Wilkes' expedition. William R. Smith became Superintendent of the Botanic Gardens in 1853. The times were troublous, and the first appropriation from Congress, including the pay of the superintendent and assistants was but $3,000. At this time the gardens were marshy, and ague-breeding. His first work was the filling in of 500,000 yards of soil. The development of the Gardens was necessarily slow and tedious, but in the period of Mr. Smith's tenure they were developed from a tiny flower-garden and botanical collection to the largest horticultural collection, public or private, in America. The work of Mr. Smith is well known to students of horticulture everywhere, and through this great work he came to be styled "the father of horticulture." G. B. BRACKETT.

Stark, James Hart, nurseryman and fruit-grower, was born July 30, 1792, in Hutchison, Bourbon County, Kentucky. He was the son of Capt. James Stark, who came to Hutchison, Kentucky, in 1785 from Virginia. The Starks were originally from Glasgow, Scotland, one brother settling in New England and the other in Virginia. Both were enthusiastic horticulturists. On a fly-leaf of one of the old law books of the Kentucky lawyer, preserved by the family, is a planting record of the family orchard which was probably the first orchard of grafted apples planted west of the Alleghanies.

For his military service in the war of 1812, Judge Stark was given script for land, in what is now Pike County, Missouri, where he located in 1815. Here, near the present site of Louisiana, he cleared a large tract of land, and went back to Kentucky for cions from the old family orchard in order to establish a nursery and orchard in Missouri. From this stock was started in 1816 the pioneer nursery west of the Mississippi. From the trees produced, the first commercial orchard in this section of the country, 45 to 50 acres in extent, was established. Northern buyers came each year and bought the crop of apples from this orchard, amounting annually to several thousand barrels. The nursery which he established in 1816 has been maintained and augmented by Mr. Stark and his descendants until today it is said to be the largest nursery in the world. Judge James Stark at first furnished trees for planting by his neighbors. In this way he began the dissemination of grafted stock of the best-known varieties of the time. The district in which he was located was also somewhat famous for wild plums, berries, grapes, and other fruit, and this stimulated in him an interest in the introduction and dissemination of new and superior varieties. The business which he established then has been responsible for the introduction into the Mississippi Valley and the far West of a very large number of the leading varieties of commercial fruits now being grown in western orchards.

Judge Stark in his day was regarded as the horticultural leader in his section of the country. That he knew thoroughly and loved his work, that he believed in it fully and got daily inspiration from it, is perhaps best emphasized by the fact that instead of his work dying with him, his inspiration, zeal and energy for it has been handed down through his descendants who have ably followed in his footsteps. J. C. WHITTEN.

Starr, Robert W., eminent fruit-grower of Nova Scotia, was born in 1830 at Starr's Point on the shore of Minas Basin. He came of an old United Empire Loyalist stock of Connecticut, a family which for four generations furnished militia officers. He was educated at Sackville Academy, New Brunswick. About the year 1860 Major Starr settled down to a life of fruit- and fruit-tree-growing, a line in which he became not only successful himself, but also of great service to his province. In addition to his vocation, he continued to serve in the militia as adjutant and later as major. In 1873 he was appointed Justice of the Peace for King's County. Major Starr was one of the original founders of the Nova Scotia Fruit-Growers' Association, which was started in 1863. Several times he was made president, and in 1873 was made a life member. In 1876 he was sent to the Centennial Exhibition, Philadelphia, with a large exhibit of Nova Scotia fruit, and in 1893 he was sent by his province to the World's Fair, Chicago, with a similar charge. Major Starr has been much in demand as a judge of apples, at exhibitions in Nova Scotia, New Brunswick, Prince Edward Island, and Ontario, and is considered the leading authority on the apple in the province of Nova Scotia.
LINUS WOOLVERTON.

Stayman, Joseph, physician and pomologist, was born in Cumberland County, Pennsylvania, October 17, 1817 and died October 4, 1903. He studied medicine and in 1846 began to deliver lectures on scientific subjects. He engaged in the practice of medicine until 1858. In 1859, he established a nursery in Illinois but later in the year moved to Leavenworth, Kansas. For forty years, he engaged in experimental work on fruits, producing hundreds of hybrids and testing many varieties produced by others. The best known of his original productions are the Clyde and Stayman strawberries, the Stayman Winesap apple and the Ozark grape. Dr. Stayman was a charter member of the Kansas State Horticultural Society and was appointed as the Kansas delegate to the Centennial Exposition at Philadelphia in 1876.

Stiles, William Augustus, journalist, editor and park commissioner, was born March 9, 1837, at Deckertown, Sussex County, in northern New Jersey, and died October 6, 1897, in Jersey City. His grandfather settled on a farm near Deckertown in 1819, where his father, Edward A. Stiles, in 1833, founded Mount Retirement Seminary, a successful school of the highest rank during the following thirty years. William A. Stiles graduated at Yale in 1859 in a class which included many men who have since attained high rank in public affairs. Prevented from taking up the profession of

law by constitutional weakness and defective eyesight, he found expression in diversified activities. He was in turn a teacher, assistant superintendent of public schools, surveyor on the Pacific coast, writer of political articles, secretary of the Senate of New Jersey, actuary of a life insurance company, and gauger in the New York custom house. During a long period of illness and almost total blindness he acquired systematic knowledge of plant-life from readings by his sisters, and this gave impulse toward subsequent study on broader lines. He brought together many rare and choice species of plants, and made interesting experiments on the farm. His articles in the daily press of New York on the various interests of country life attracted wide attention, and led to his appointment as an editorial writer of the New York "Tribune," a relation which continued throughout his lifetime. In 1883 he became agricultural editor of the Philadelphia "Press." Keenly interested in introducing scientific discoveries and improved methods into general practice, he established relations with the foremost agriculturists abroad and at home, and made his department a useful and valuable exponent of the best knowledge of the time. His masterly conduct of the page during the next five years set a high standard for journalism in this field, and established his reputation as a specialist in agriculture and cognate subjects. On the founding of "Garden and Forest" in 1888, William A. Stiles was invited to be the managing editor. For nearly ten years, to the close of his life, he devoted himself to this journal through vigorous editorial writing and management, and steadily maintained the high character of the most able and influential periodical in American horticultural journalism. For many years he rendered conspicuous service in working for the establishment of small parks easily accessible to the poor, and for the wise conduct of the larger parks and their preservation from invasion and despoilment. His special ability and influence received public recognition in 1895, when he was appointed a park commissioner of New York city, a position in which he rendered signal and valuable service until the time of his death.

M. B. COULSTON.

Strauch, Adolph (Fig. 1900), landscape-gardener, was born in Prussia, August 30, 1822, and died at Cincinnati, Ohio, April 25, 1883. He began the study of landscape gardening at the age of sixteen, and perfected his knowledge and taste by travel and by working in many places, including Vienna, Schoenbrun, Luxemburg, Berlin, Hamburg, The Hague, Amsterdam, Ghent and Paris, spending several years at the latter place. In 1848 he went to London where he found employment in the Royal Botanic Gardens. In 1851 he came to the United States, landing at Galveston, Texas. From there he found his way to Cincinnati, and made that his home during the rest of his life. Mr. Strauch designed portions of the parks and many of the private grounds in Cincinnati. "Clifton" in that city, owed its beauty to his skill and good taste. Mr. Strauch's chief claim to distinction however, was in originating the park-like treatment of cemeteries. He developed his ideas in Spring Grove, which became the most beautiful cemetery in the world. His skill as a landscape gardener was called into requisition in many places, among which are included Buffalo, Cleveland, Toledo, Detroit, Chicago, Indianapolis, Nashville and Hartford. Frederick Law Olmsted used to say that when he needed inspiration he visited Spring Grove. Perhaps no man in the United States since A. J. Downing's time has done more for the correction and cultivation of public taste in landscape gardening than Adolph Strauch. He loved nature and tried to preserve her natural beauty. He was especially successful in grading land surfaces and securing beautiful rolling lawns, the shaping of which was done almost entirely by eye. He would say "When it pleases the eye, it is right." He also said that the lawn at the margin of a road should be tangent to the road's surface. He believed in the picturesque arrangement of trees and shrubs, and was very careful to use species that harmonize with each other.

O. C. SIMONDS.

1900. Adolph Strauch.

Stringfellow, Henry Martyn (Fig. 1901), was born at Winchester, Virginia, January 31, 1839, and died on June 17, 1912, at Fayetteville, Arkansas. He was graduated from William and Mary College in 1858. Later he attended the Virginia Theological Seminary at Alexandria, 1858–61. Enlisting in the Confederate Army in 1861, he soon rose from the rank of private to the rank of captain in the Ordinance Department. He studied law for several years. Much of his life was spent in Texas, where he was a pioneer in discovering and demonstrating the rich horticultural possibilities of the Gulf coast. He planted the first pear orchard on the coast in 1882. In 1884, he planted the first Satsuma orange trees in Texas—trees which he obtained from Japan. These plantings were at Hitchcock. In this single instance, he rendered American horticulture a service of vast importance, since during the past few years millions of Satsuma orange plantings have been made all along the Gulf coast and a vast industry has been created. By demonstrating the value of drainage and by other methods, he opened up the horticultural possibilities of the country lying between Houston and Galveston, previously regarded as waste land. This is now the pear and strawberry country of Texas. He was a frequent contributor to horticultural publications and the press. Some of his articles appeared in the press of some foreign countries. His book "The New Horticulture" was written and published at Galveston in 1896. Most notable of the new practices which he advocated in this book was a severe method of pruning young fruit trees, both tops and roots, preparatory to transplanting. This practice, which he called "close root-pruning," sometimes called the "Stringfellow method," again "stub-pruning," proved successful in sandy types of soil southward, and was adopted by many planters, especially of large peach orchards in the South.

1901. Henry M. Stringfellow.

ERNEST WALKER.

Strong, William Chamberlain, lawyer and pomologist, was born at Hardwick, Vermont, August 18, 1823, and died in New York City, May 11, 1913. He was a graduate of Dartmouth College and then entered the Harvard Law School, for several years practising law.

His interest in horticulture, however, caused him to give up law as a profession, and buy an estate at Waban, Massachusetts. He did much for American fruit-culture, especially the grape and pear industries, and he was regarded as a leader among old-line pomologists. He was also a benefactor in the introductions of new plants and trees from foreign countries. He was among the first to discover the immense floral value of rhododendrons and azaleas for the vicinity of Boston. He also did much to aid in the establishment of the Arnold Arboretum in 1872. Mr. Strong was the author of several valuable books on horticulture, some of which are "Fruit-Culture," "Grape-Culture," and the "Gardener's Manual." He was a member of the Massachusetts Horticultural Society, and in 1872 was sent to Paris as a delegate to the Pomological Congress. He was also a member of the American Pomological Society. G. B. BRACKETT.

Sturtevant, Edward Lewis, agricultural experimenter and writer, was born in Boston, Massachusetts, January 23, 1842, and died at South Framingham, Massachusetts, July 30, 1898. Though holding the degree of M. D. from the Harvard Medical School, Dr. Sturtevant never practised the profession of medicine, but devoted his life to agricultural work, first specializing on Ayrshire cattle, then on pedigree corn (Waushakum) and muskmelons (New Christiana), and afterward devoting particular attention to the modifications which cultivated plants have undergone as shown by such records as occur in the older books. In connection with these studies, Dr. Sturtevant brought together a rare collection of books dealing with plants published before the time of Linnæus (say 1753), which, with his index cards and herbarium, is now preserved at the Missouri Botanical Garden in St. Louis.

As first director of the New York Experiment Station at Geneva, Dr. Sturtevant drew the broad plans on which the successful work of that establishment has been conducted and which have served largely as models for subsequently organized agricultural stations over the country. He was a man of active mind, and his career is suggestive of worthy work to an unusual degree. A biographic sketch and a list of his principal writings are printed in the "Tenth Report of the Missouri Botanical Garden." See also "Cyclopedia of American Agriculture," Vol. IV, p. 616.

Teas, John C., nurseryman, was born in Indiana, of Quaker parentage, in 1827 and died in Carthage, Missouri, July 29, 1907. At the early age of ten, he evinced his love of horticulture by planting and tending a garden of his own. He lived in Indiana until 1869, when he moved to Missouri, where he engaged in the nursery business. He originated and introduced many new and valuable novelties in all branches of horticulture, including pomology, forestry, floriculture and the like. He was one of the first to recognize the good qualities of *Catalpa speciosa* and at all times advocated the careful conservation of our natural forests, and the planting and care of new forests. Mr. Teas was an active member of the American Pomological Society and one of the organizers of the Indiana Horticultural Society. He was also a frequent contributor to the current literature of horticulture and pomology.

Terry, H. A., one of the pioneer horticulturists of the prairie region west of the Mississippi, was born in Cortland, New York, in 1826. At the age of ten he moved with his parents to Michigan, where he lived on a farm until he was nineteen. He then went west stopping a year in Illinois, reaching western Iowa in 1846. After that the most of his life was spent in the vicinity of Council Bluffs, not far from which city he established a nursery in 1857, where he carried on the work in breeding fruits and flowers which has given him special claim to recognition as one of the notable horticulturists of his region. In addition to carrying on his regular business as a nurseryman, he endeavored to add to the list desirable varieties which should be particularly adapted to his region at a time when such work was greatly needed. He named and distributed more than 100 of his seedling peonies, but doubtless his most important work was the origination of improved varieties of the native plum. Among the more important of his plum seedlings, classed under the americana species, are Admiral Schley, Bomberger, Bryan, Champion, Golden Queen, Hawkeye, Nellie Blanch, Terry and White Prune. Among his notable seedlings of the Munsoniana species are Downing, Hammer, Milton, all three from seed of the Wild Goose. Mr. Terry was long an active member of the State Horticultural Society and for several years was in charge of one of its trial stations. He died February 14, 1909. S. A. BEACH.

Thomas, John Jacobs (Fig. 1902), one of the three pomologists who may be said to have created the science in this country (the others being Patrick Barry and the elder Downing), was born January 8, 1810, near the lake in central New York—Cayuga—on the shores of which he passed his life; and died at Union Springs, February 22, 1895. He was much more than a pomologist, his studies covering nearly every branch of rural industry except the breeding of live-stock, and his labors in the direction of adorning the surroundings of country life entitling him to rank in that department with the younger Downing. Two of his works, "Farm Implements and Machinery," and the series of nine volumes called "Rural Affairs," deal with the practical every-day matters of life on the farm in a manner at once pleasing and original, there being nothing that could quite fill their place in the whole range of our agricultural literature; and his incessant stream of inspiring editorials in "The Cultivator" and "The Country Gentleman" for nearly sixty years covered a wide and diversified range of rural topics. But pomology was his chief delight, and his fame rests mainly on his treatise on that subject, "The American Fruit Culturist." This immensely useful book first appeared, in 1846, as a paper-covered 16mo of 220 pages, with 36 wood-cuts, which must have been well received, inasmuch as a fourth edition (dignified with muslin binding) was published in the following year, and in 1849 another, enlarged to 424 duodecimo pages, and "illustrated with 300 accurate figures." This edition appears to have been reissued a few years later, with slight modifications and on larger paper, and was then called the seventh. Up to this time, changes in the work had been chiefly in the direction of natural growth. But horticultural knowledge was undergoing great modification; and in 1867, the public still calling for the book, it reappeared in different style, newly arranged and mostly rewritten, filling now considerably more than 500 pages, and accompanied by almost that number of illustrations. Rather unfortunately, this was called the "second edition," all its predecessors being probably regarded as different forms of the same book, while this was substantially new.

1902. John Jacobs Thomas.

The next edition, called the "eighth revised," appeared in 1875, and had nearly 600 octavo pages and over 500 engravings,—not to mention a colored frontispiece and highly pictorial binding; and this was followed, ten years later, by a revised reprint in plainer and more tasteful style, illustrated with the largest number of engravings yet reached, 519. This edition, the last issued during the life of the author, sold well, like all the others, and was long out of print and much sought for. A so-called "twentieth" edition, revised and enlarged by Mr. William H. S. Wood, with the assistance of a number of high authorities, appeared in 1897, and contains over 700 pages and nearly 800 illustrations. A "twenty-first" edition has also appeared.

GILBERT M. TUCKER.

Thorburn, Grant (Fig. 1903), founder of the seed house of J. M. Thorburn & Co., New York, and horticultural author, was born in 1773 in Dalkeith, Scotland, and early came to New York to seek his fortune. His father was a wrought-nail maker, and the son engaged in the same trade in this country. He soon married, and his wife attended a store which he established in Nassau Street, near Liberty, for the selling of "tape, ribbons, thimbles, thread, scissors, and Oxbery's needles." The living-rooms were in connection. "A glass door opened opposite the fireplace, where she rolled the dumpling or broiled the steak with one eye, and kept a squint on the store with the other." The introduction of cut-nail machines deprived young Thorburn of his trade, and the establishment of a pretentious grocery business on the corner of Nassau and Liberty streets took away his customers. He therefore gave attention to other means of livelihood. The women of the city had begun to show a taste for flowers. These were grown in pots, and the pots were sold by grocers. In the fall of 1802, there being various pots in his stock, Thorburn thought to attract the attention of purchasers by painting the pots green. Four pots were first painted. They sold quickly. Then he painted twelve. They sold; and thus the pot business grew. Thorburn had been in the habit of buying his meat at the Fly Market, at the foot of Maiden Lane. In April, 1803, he bought a rose geranium there, thinking to be able by its means still further to advertise his pots. But the next day a customer bought both pot and plant; and Thorburn quickly returned to the market and bought two more plants. These sold; and thus the plant business grew.

1903. Grant Thorburn.

The man, George Inglis, of whom Thorburn bought the plants, was also a Scotchman, and it was soon agreed that one should grow the plants and the other sell them. But the customers also wanted to grow plants, and they asked for seed; and, as there was no seedstore in New York, it was arranged that Inglis should grow seeds also. This was in 1805; and in that year Inglis, as an experiment, had grown a lot of seeds. Thorburn bought these seeds for $15; and thus arose the first regular seedstore in New York, and one of the first in the United States.

The seeds and plants continued to sell, and Thorburn was obliged to import seeds. In 1805 or 1806 he obtained a catalogue of William Malcolm & Co., London, the first plant catalogue he had ever seen, and he then published one of his own. This led to more pretentious writing, and "The Gentleman and Gardener's Kalendar" was the first outcome. The third edition of this, in 1821, by "Grant Thorburn, Seedsman and Florist," contains the advertisment of "G. Thorburn & Son," dealers in seeds, implements and rural books.

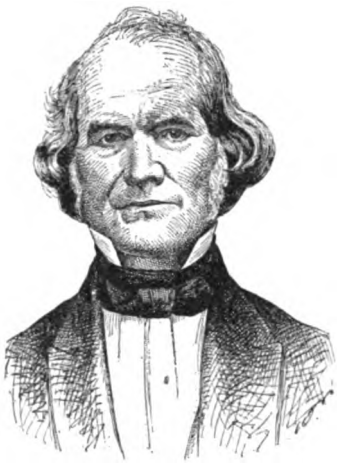
Grant Thorburn was a prolific writer for the current press on a variety of topics, under the *nom de plume* of Laurie Todd. He was a unique character, and his history,—"mixed with much fiction," as he himself says,—was the basis of John Galt's tale in three volumes (London, 1830) of "Lawrie Todd, or Settlers in the Woods." Thorburn left a most interesting autobiography, which was published in New York in 1852. He died in New Haven, Connecticut, January 21, 1863, at the age of 90. The portrait in Fig. 1903 is reproduced from his autobiography. See p. 1518. L. H. B.

Thurber, George, botanist, naturalist and editor, was born in Providence, Rhode Island, September 2, 1821, and died at his home near Passaic, New Jersey, April 2, 1890. In his early years he devoted himself eagerly to the study of chemistry and natural sciences in general, but especially to botany, so that at an early age he was already well known as one of the most prominent botanists of the country. This brought him in close intimacy with John Torrey, Asa Gray, George Engelmann, Louis Agassiz and other eminent scientists, whose warm friendship he enjoyed until his death. In 1850 he obtained the appointment as botanist, quartermaster and commissary of the United States Boundary Commission for the survey of the boundary between the United States and Mexico. During the following four years his botanical work consisted mainly in the exploration of the native flora of these hitherto unknown border regions. His herbarium collected there comprised a large number of species new to scientists, some of which have been named after their discoverer, *Cereus Thurberi* being one of the most important; it is now cultivated for its fruit in the desert regions of North Africa. This historical herbarium formed the subject of Dr. Asa Gray's important work "Plantæ Novæ Thurberinanæ," published by the Smithsonian Institute. After his return to New York in 1853, Dr. Thurber received an appointment to the United States Assay Office, of which Dr. John Torrey was the assayer. In this position he remained until 1856, when owing to his strong sympathies with Gen. John C. Fremont, who was the first presidential candidate of the Republican party, he preferred to resign rather than sacrifice his principles. During the following three years he was connected with the Cooper Union and the College of Pharmacy of New York City as lecturer on botany and materia medica. In 1859 he was appointed professor of botany and horticulture at the Michigan Agricultural College, which position he held for four years. This position he resigned in 1863 to accept —on the urgent invitation of Orange Judd, the publisher—the editorship of the "American Agriculturist," which he held to within a few years of his death, when failing health prevented him from continuing his ardent labors. In this position he found his most congenial work and the real mission of his life, for which his previous training had fitted him so admirably. Few men have exerted so powerful and effective an influence on progressive horticulture and agriculture. The amount of his writings in the "American Agriculturist" during the twenty-two years of his connection with it was enormous, but as his name but rarely appeared with his articles it would be impossible to estimate the aggregate, yet whatever he wrote bore the stamp of accuracy of detail and naturalness of style. While in Michigan he revised and partly rewrote Darlington's "Agricultural Botany," which was published under the title of "American Weeds and Use-

ful Plants." He wrote also the entire botany of Appleton's "New American Encyclopedia." An important part of his contributions to horticultural literature consisted in editing, revising and bringing out the horticultural and agricultural books of the Orange Judd Company. After the death of Dr. Torrey, he was elected president of the Torrey Botanical Club. He was also president of the New Jersey Horticultural Society; vice-president of the American Pomological Society for New Jersey; and honorary member of many scientific societies throughout the world.

F. M. HEXAMER.

Tucker, Luther, (Fig. 1904), editor, was born at Brandon, Vermont, May 7, 1802, and died January 26, 1873. He was the founder of "The Horticulturist" and the proprietor of that valuable and unique magazine during the period of its greatest glory—from July, 1846, until the autumn of 1852. To A. J. Downing, however, belongs the credit for the distinguished interest and value of the magazine, as he conducted it according to his own ideas, with which the proprietor never interfered, the latter having indeed enough to do in putting it before the public with enterprise and vigor. It was issued simultaneously in Albany, Boston, New York and Philadelphia, with twenty-two special agencies at other points, including what was then the distant western town of Cleveland, Ohio, as well as Hamilton and Cobourg in "Canada West." Luther Tucker also founded, at Rochester, New York, October 27, 1826, the first daily paper published west of New York, "The Advertiser," which is still, under a slightly extended name, an influential journal; also at Rochester, January 1, 1831, "The Genesee Farmer," a weekly, the first agricultural periodical in the world written directly from the standpoint of practical experience. It has undergone some changes in name, as its scope extended far beyond the Genesee Valley, being now called "The Country Gentleman." It was published in Albany by the founder and his sons, from January, 1840, until July, 1911, when it was sold to the Curtis Publishing Company of Philadelphia. This is one of the ten American agricultural periodicals that were started before 1850 and outlived the nineteenth century, the others being these: "Maine (Kennebec) Farmer," 1839; "American (Boston) Cultivator," 1839; "Southern Planter," 1840; "Massachusetts Plowman," 1841; "Prairie Farmer," 1841; "American Agriculturist," 1842; "Southern Cultivator," 1843; "Indiana Farmer," 1845; "Rural World," 1848; "Ohio Farmer," 1848. It was natural that Luther Tucker should be interested in the New York State Agricultural Society, which he found at a low ebb on his coming to Albany, and of which, only a year later, he was the chief reorganizer, getting on foot the long series of annual fairs beginning in 1841 and still continued. He served the Society without any compensation or even reimbursement for his own expenses, for eleven years.



1904. Luther Tucker.

GILBERT M. TUCKER.

Vaux, Calvert (1824–1895), an American landscape gardener, was born in London. Together with Frederick Law Olmsted he planned Central Park, New York, the prototype of large, accessible, nature-like city parks. The following account of his life-work is taken with slight changes from an obituary notice by Wm. A. Stiles in "Garden and Forest" 8:480. He had achieved success in architecture before the age of twenty-four, when he came to America as business associate of Andrew Jackson Downing. At the time of Downing's untimely death in 1854 the two men were designing and constructing the grounds about the Capitol and Smithsonian Institution, the most important work of the kind that had yet been attempted in America. Meanwhile, the gathering sentiment in favor of spacious and accessible city parks which had found expression in eloquent letters of Downing, at last secured, through legislative action, the purchase for a public pleasure-ground of the rectangular piece of ground now known as Central Park, New York. In 1858 the city authorities selected, out of thirty-three designs offered in competition for the new park, the one signed "Greensward," which was the joint work of Frederick Law Olmsted and Calvert Vaux, and Central Park as we know it today is the realization of this design in its essential features. It may be added that this "Greensward" plan, together with other reports on Central Park, on Morningside and Riverside Parks, in New York, on parks in Brooklyn, Albany, Chicago, San Francisco and other cities, both in this country and the Dominion of Canada, by the same authors, contain a consistent body of doctrine relating to public pleasure-grounds which is unique and invaluable. Calvert Vaux was a member of many important commissions, and he acted as landscape gardener for the Niagara Falls Reservation, but for more than thirty years his best work and thought were steadily given to the parks of New York City. He had the genuine creative faculty which gave the stamp of originality to all his work, and a severity of taste which preserved it from anything like eccentricity or extravagance. As a city official he was a model of intelligent zeal and sturdy integrity. Several times he resigned his lucrative position rather than see his art degraded, but he was always quickly reinstated by a demand of the people. See *Olmsted*, p. 1589; also *Landscape Gardening*, Vol. IV.

WILHELM MILLER.

Vick, James (Fig. 1905), seedsman and editor, was born at Portsmouth, England, November 23, 1818, and died at Rochester, New York, May 16, 1882. He came to America at the age of twelve, learned the printer's trade, and in 1850 became editor of the "Genesee Farmer," then published at Rochester by Luther Tucker and subsequently absorbed by "The Cultivator." In 1853 he purchased Downing's magazine, "The Horticulturist," and published it for a time, the editor being Patrick Barry. In 1860 Vick entered the seed business and his trade soon grew to large proportions. For about twenty years his name was a household word, being associated especially with flowers. In 1878 he founded "Vick's Magazine." Vick's personality was thoroughly amiable, and his letters in "Vick's Magazine" to children and to garden-lovers everywhere show the great hold he had on the hearts of the people.

1905. James Vick.

WILHELM MILLER.

Warder, John Aston (Fig. 1006), physician, author, horticulturist, and forester, was born at Philadelphia, January 19, 1812. His early life was spent in a suburban home, where he evinced a love of nature which he cherished through life. Bartram and Darlington were among his neighbors and he met in his father's house men like Audubon, Michaux and Nuttall. In 1830 his parents moved to Springfield, Ohio, where he helped clear up a farm and first became interested in agricultural sciences and comparative anatomy. He was graduated at Jefferson Medical College, Philadelphia, in 1836. He settled in Cincinnati in 1837 and began the active practice of medicine. He was early elected a member of the school board and did faithful service for many years, making it his business to travel through the eastern states and cities to study systems of teaching in order to introduce improved plans into the Cincinnati schools. He was actively interested in and a prominent member of the Cincinnati Astronomical Society, the Western Academy of Natural Sciences, the Cincinnati Society of Natural History. He was one of the founders of the Cincinnati Horticultural Society and the Wine-Growers' Association. He was also prominent in the old Cincinnati College and afterward in both the Ohio and Miami Medical Colleges. He was for many years president of the Ohio Horticultural Society and vice-president of the American Pomological Society. He was among the first to draw public attention to the improvement of public grounds, private parks and cemeteries. The present interest in landscape-gardening in this country is largely due to his efforts and writings. He was interested in establishing the famous Spring Grove Cemetery, one of the earliest and best of landscape or lawn cemeteries, and was one of the first residents of Clifton, whence he moved to a farm near North Bend, Ohio, formerly owned by President Harrison. There he spent most of his time in testing varieties of fruit and methods of culture, and prepared numerous practical papers for horticultural societies and other readers, and in fact established a private experiment station.

In 1870 he began the publication of the "Western Horticultural Review," which continued four years. In one number is contained the first description of the *Catalpa speciosa*, now recognized as one of the valuable forest trees. His report of the Flax and Hemp Commission, published by the Government in 1865, was the result of much patient study and investigation. "Hedges and Evergreens" appeared in 1858. "American Pomology—Apples," published in 1867, was the result of more than sixteen years of careful study, aided by hundreds of correspondents in various parts of the central states. It is still considered a standard authority on description and varieties of apples, containing a table of varieties and synonyms of over 1,500 names.

1006. John Aston Warder.

A report upon forests and forestry was the result of his visit to the World's Fair at Vienna in 1873, as United States Commissioner. In 1875 he issued a call for a convention at Chicago to form an American Forestry Society, which organization was completed at Philadelphia in September, 1876. The public was not yet impressed with the importance of the subject, but this pioneer association gave impetus to the plans for united effort. In 1879–80, with the approval of various societies, Dr. Warder memorialized Congress, asking for a commission for the study of forestry in Europe, but general interest was not thoroughly aroused until, largely through his efforts, the American Forestry Congress held its meeting in Cincinnati in April, 1882. He was honorary president of the Ohio State Forestry Society, prepared strong memorials to Congress on behalf of the forests and was shortly afterward appointed agent of the Department of Agriculture to report upon forestry of the northwestern states. He was devoted in his interest in all which concerns rural life and industry; his efforts had a great and marked effect on the horticulture and outdoor art of the great central states. Death ended an active and useful life July 14, 1883.

R. H. WARDER.

Wellhouse, Frederick, judge and pomologist, was born in Wayne County, Ohio, November 16, 1828, and died at Topeka, Kansas, January 10, 1911. He was the son of a pioneer and received his early education in the typical log schoolhouse of the early days. He got his knowledge of farming at first hand on his father's 300-acre farm. In 1858 he published the "Indiana Farmer," a monthly agricultural paper, which he sold to his partner, J. N. Ray, in 1859, and afterward moved to Leavenworth, Kansas, and engaged in horticulture. During the Civil War, he was captain of the 19th Regiment, Kansas State Militia. He was elected county commissioner of Leavenworth County in 1861 by an almost unanimous vote. He was the Republican nominee for senator in 1864, but was defeated. He served two terms in the Kansas legislature, 1884–8. He was an active member of the State Horticultural Society, almost from its organization, and was for fifteen years its treasurer and four years its president. He represented the state of Kansas in the fruit display for the World's Columbian Exposition, Chicago, 1903, and did much pioneer work in Kansas horticulture in early days when that work demanded a leader. He represented the state's fruit industry at the various state fairs and the national expositions. He planted the largest commercial orchard in Kansas, and it was for many years the largest apple orchard in the world, an orchard of over 1,600 acres, that justly entitled him to the name of the "Apple King." This initial orchard was planted in 1876, and he added to the plantings for a number of years. In 1880 the yield from his orchard was 80,000 bushels besides the culls and it required 200 cars to ship them east. The yield for eleven years, from his first plantings, was 239,135 bushels which sold for $125,118.25. In the twenty-five years' trial of his commercial orchard he found Jonathan the most profitable variety; Missouri (Pippin) second best; Ben Davis third and Winesap fourth.

G. B. BRACKETT.

Wharton, Silas, pioneer nurseryman and pomologist, was born in 1775 in Bucks County, Pennsylvania. He removed to Waynesville, Ohio, about 1820 and was a celebrated pioneer nurseryman of that state. He grew Morello, May Duke and Carnation cherries, Red June, Summer Pearmain, Trenton Early, Summer Rose, English Hagloe, Ribston, Golden Pippin, Pennock and many other well-known apples. The Miami Valley and the neighborhood about Dayton, Ohio, are more indebted to Silas Wharton for intelligent fruit-growing at an early day, than perhaps to any other man. He was a warm friend of Coxe, the pioneer pomologist and author, and doubtless Coxe secured much valuable data from him for his book, "A View of American Fruits." Silas Wharton died in 1858.

G. B. BRACKETT.

White, William Nathaniel, teacher, horticulturist and editor, was born in Stamford, Connecticut, Novem-

ber 28, 1819, and died in Athens, Georgia, July 14, 1867. He was a graduate of Hamilton College, New York, a teacher in Atlanta, Georgia, and upon removing to Athens, he became one of the most prominent horticulturists of the South. He was a contributor to many agricultural and horticultural periodicals, both North and South, and before and during the time of the Civil War, he was owner and editor of the "Southern Cultivator." He was also author of "Gardening for the South," which book was published in 1856; after his death two more editions were published, one in 1867, and the last in 1901. His useful life was spent in the upbuilding of southern horticulture and agriculture. For a more detailed account see "Cyclopedia of American Agriculture," Vol. IV, p. 625.

T. H. McHATTON.

Wilder, Marshall Pinckney (Fig. 1907), distinguished amateur pomologist and patron of horticulture, was born at Rindge, New Hampshire, September 22, 1798, and died at his home near Boston, December 16, 1886. His inherited love of country life soon showed itself, and at the age of sixteen he chose farm work in preference to a college course. At twenty-seven he moved to Boston, where he was long known as a prosperous merchant and president of many societies and institutions. His active interest in horticulture may be dated from 1832, when he purchased a suburban home at Dorchester, where he lived for more than half a century. His pear orchard at one time contained 2,500 trees, representing 800 varieties. During his life he tested 1,200 kinds of pears and in 1873 he exhibited 404 varieties. He produced several new pears. In 1844 he introduced the Anjou. He imported many fruits and flowers new to America, and from 1833 to the end of his life he was constantly contributing to the society exhibitions the products of his garden. He carried a camel's-hair brush in his pocket and was always hybridizing plants.

1907. Marshall P. Wilder.

He delighted in floriculture, and his camellia collection, comprising at one time 300 varieties, was the best in America. He raised many new kinds of camellias, though he lost 500 seedlings by fire. His *Camellia Wilderi* he sold to florists for $1,000. He also had a notable collection of azaleas. As early as 1834 he produced a double California poppy. Among the many floral novelties which he was first to import, cultivate or exhibit in America were *Diervilla rosea* (1851), hardy kinds of *Azalea mollis* (1874), *Cissus discolor* (1854), "the harbinger of the infinite variety of ornamental-leaved plants now so generally cultivated and admired," *Clematis cærulea* var. *grandiflora* (1841), *Lilium lancifolium* var. *album*, the first of Japanese lilies, *Gladiolus floribundus* (1836), and *Oncidium flexuosum* (1837), a plant of which bore ninety-seven fully expanded flowers and was the first orchid reported at any American exhibition. The Marshall P. Wilder rose makes his name familiar to a later generation.

Wilder's greatest services to horticulture were connected with the Massachusetts Horticultural Society and the American Pomological Society. Of the former he was a member for fifty-six years, and president from 1841 to 1848. He was one of the founders of the American Pomological Society, and with the exception of a single term was its president from its organization in 1850 until his death in 1886. He is counted one of the founders of the Massachusetts Board of Agriculture and of the Massachusetts Agricultural College, and of the United States Agricultural Society (1852). He was president of the last from its foundation until 1857, and from 1868 until his death he was president of the New England Historic Genealogical Society. At twenty-six he was a colonel, and in 1858, after declining the nomination four times, he was elected commander of the Ancient and Honorable Artillery Company. He was a trustee of the Massachusetts Institute of Technology.

In 1883 Marshall P. Wilder urged upon the American Pomological Society the necessity of a reform in the nomenclature of fruits. He took an active part in the great work that followed.

In the early days when the conflicting interests of the Massachusetts Horticultural Society and the Mount Auburn Cemetery required separation, he was an important factor in solving the complicated and delicate problem. The settlement of this difficulty laid the foundations of the wealth of the Massachusetts Horticultural Society.

At his death he left the American Pomological Society $1,000 for Wilder Medals for objects of special merit and $4,000 for general purposes. He left the Massachusetts Horticultural Society $1,000, to encourage the production of new American varieties of pears and grapes.

WILHELM MILLER.

Woolverton, Charles Edward, pomologist, and nurseryman, was born in Grimsby, Ontario, August 22, 1820. He was the youngest son of Dennis Woolverton, of New Jersey, who settled on a farm of 400 acres on the south side of Lake Ontario, in the Niagara district in 1798. Here Charles became accustomed to every department of work both in farm and orchard. He was educated at Madison (now Colgate) University, and in 1846 settled upon a portion of the old homestead. In 1856, in company with A. M. Smith, he devoted a considerable portion of his farm to nursery and orchard, in which business he was quite successful, distributing fruits and fruit trees throughout a considerable portion of Ontario, Quebec and Nova Scotia. At Grimsby, he planted the first large commercial orchard of peach trees and proved the adaptability of the soil and climate of the Niagara district for the production of peaches and sweet cherries. In company with Messrs. Beadle, Smith, Arnold, Judge Logie and several others, Mr. Woolverton was instrumental in the formation of the Fruit-Growers' Association of Ontario, which afterward reached a membership of over 5,000, and was the chief agent in the encouragement and development of horticulture in southern Ontario. He died in August, 1900.

LINUS WOOLVERTON.

HOSÁCKIA (David Hosack, professor of botany and medicine in New York; author of "Hortus Elginensi," 1811; died 1835). *Leguminòsæ*. Herbaceous plants, three of which have been advertised by collectors of northwest American plants.

The genus contains about 40–50 species, all American and mostly confined to the Pacific slope: herbs or rarely subshrubs: lvs. pinnate, with 2 to many lfts.: stipules minute and gland-like, rarely scarious or leafy: fls. yellow or reddish, in axillary umbels which are peduncled or not.—The genus is closely related to Lotus, with which some authors unite it, but the calyx-teeth are shorter than the tube: keel obtuse: lvs. usually with numerous lfts., none of which is like stipules, while Lotus has calyx-lobes usually longer than the tube, a rostrate keel and 5 or 4 lfts., of which 2 or 1 are stipule-like. The two species first mentioned belong to a sec-

tion in which the pods are shortly acute, linear, many-seeded, straight, glabrous: fls. and fr. not reflexed: peduncles long. The third species belongs to a section in which the pods are long-attenuate upward, incurved, pubescent: peduncles short or none: fls. and fr. reflexed. See *Lotus*.

crassifòlia, Benth. (*Lòtus crassifòlius*, Greene). Stout, 2–3 ft. high, nearly glabrous: lfts. 9–15, thickish: stipules scarious, small: bract below the umbel: calyx-teeth short: pod thick: fls. greenish yellow or purplish. Dry places in mountainous country, Calif. B.R. 1977 (as *H. stolonifera*).

bícolor, Douglas (*Lòtus pinnàtus*, Hook.). Glabrous: lfts. 5–9: stipules scarious, small: bract usually none or small: calyx-teeth half as long as the tube: pod slender: fls. yellow, the wings often white. Cent. Calif. to Wash. B.R. 1257. B.M. 2913.

decúmbens, Benth. (*Lòtus Douglasii*, Greene). Silky or woolly, with appressed hairs: sts. ascending, 1 ft. or more long, herbaceous: lfts. 5–7: umbels less dense: stipules glandlike: pods pubescent. N. Calif. to Wash.

WILHELM MILLER.

HÒSTA (personal name). *Fúnkia* of Sprengel, sometimes spelled Funckia. The *Funckia* of Willdenow is *Astelia*. *Liliàceæ*. DAY LILY. PLAINTAIN LILY. Hardy perennials of China and Japan, much planted for their masses of root-leaves and for their white and bluish flowers; the funkias of garden literature. Sometimes spelled Hostia.

1908. Hosta plantaginea. (×⅓)

Herbs, forming stools or clumps: lvs. petiolate, ovate or lance-ovate, prominently several-ribbed, those on the flowering sts. smaller and becoming bract-like: fls. in terminal racemes or spikes, white or blue; perianth funnelform, 6-parted and more or less irregular, the lobes not widely spreading; stamens 6, the filaments filiform, the anthers long-oblong and versatile: pod oblong and angled, many-seeded, splitting into 3 valves; seeds flat and black, winged at the apex.—Species about 10. In cult., the synonymy seems to be much confused.

The hostas are hardy and of the easiest culture. Their dense stools or clumps of foliage are in place along walks or drives and in the angles against buildings. A continuous row along a walk gives a strong and pleasing character. Make the soil rich and deep. The clumps improve with age. The large-leaved kinds grow vigorously in moist, shady places. Of some varieties the leaves are strikingly variegated. They bloom in summer. Foliage is killed by frost. Propagation is by dividing the clumps; some species produce seeds freely, and seedlings can be grown readily if seed is sown as soon as ripe.

A. *Fls. white, ascending; fl.-bract very large, with a smaller one inside.*

plantagínea, Aschers. (*Hemerocállis plantagínea*, Lam. *H. álba*, Andr. *Fúnkia subcordàta*, Spreng. *F. álba*, Sweet. *F. liliiflòra*, Hort. *F. japónica*, Hort., at least of some. *F. cordàta*, Hort., not Sieb.). Fig. 1908. Lvs. large, broadly cordate-ovate, with a short, sharp point, green, many-ribbed: fls. large, 4–6 in. long, with an open bell-shaped perianth, waxy white, the base of the tube surrounded by a broad bract; spike short, the bracts very prominent:—The commonest species in old yards, and an excellent plant. The fls. have an orange-like odor. Clumps of foliage grow 12–20 in. high. B.M. 1433 (as *Hemerocallis japonica*). Gng. 9:97.

Var. **grandiflòra,** Hort. (*F. grandiflòra*, Sieb. & Zucc.), has very long and large fls. G.C. III. 4:153. G. 5:503; 23:591. *H. macrántha*, Hort., probably belongs here.

AA. *Fls. blue or lilac, more or less inclined or nodding; bract 1.*

B. *Lvs. glaucous.*

Sieboldiàna, Engler (*Fúnkia Sieboldiàna*, Hook. *F. Sièboldii*, Lindl. *F. glaùca*, Hort. *F. sinénsis*, Sieb. *F. cucullàta*, Hort. *F. glaucéscens*. Hort. *F. cordàta*, Sieb.). Differs from the last in the metallic blue color of the less cordate lvs., in the inclined bluish or pale-tinged, more slender-tubed and smaller fls. (which do not rise above the foliage), and in having only 1 small bract at the base of the fl. B.M. 3663. B.R. 25:50. L.B.C. 19:1869 (as *Hemerocallis Sieboldiana*). G. 10:387; 13:3. G.C. III. 38:94. There is a form with the body of the lf. yellowish white and the edge green. Lowe, 34. —Lf.-blade and petiole each 1 ft. long, the foliage therefore overtopping the fls. *F. Sieboldii elatior* and *F. sinensis marmorata*, are offered abroad. The plant usually cult. as *Funkia Sieboldiana* is probably the following species.

Fórtunei (*Fúnkia Fórtunei*, Baker. *Hòsta Sieboldiàna*, var. *Fórtunei*, Voss). Plant differs from *H. Siéboldiana* in having smaller lvs. and the racemes much overtopping the foliage, as in other hostas: petiole 2–3 in. long; blade cordate-ovate, 4–5 in. long: raceme ½ft. long on a st. or scape 1 ft. long; fls. pale lilac, funnel-shape, 1½ in. long, the segms. lanceolate and ascending and half as long as the tube.—Excellent. Generally cult. as *Funkia Sieboldiana*, and many of the pictures of that name, probably belong here, as, apparently, Gn. 38, p. 79; A.G. 11:157; A.F. 6:322. It is probable that the garden synonyms cited under *H. Sieboldiana* are usually applied to plants of *H. Fortunei*. A var. **gigantèa** is offered, with lvs. and fls. much larger than in the type. Vars. **robústa,** and **argénteo-variegàta,** are also listed abroad.

1909. Hosta cærulea. (×⅓)

BB. *Lvs. green.*

cærùlea, Tratt. (*Fúnkia cærùlea*, Sweet. *F. ovàta*, Spreng. *F. lanceolàta*, Sieb.). Figs. 1909, 1910. Lvs. broad-ovate, 5–10 in. long and half as wide, usually tapering to the petiole, but sometimes subcordate: raceme long and lax; fl. with a short, slender tube and suddenly expanding into a bell-shape, 1½–2 in. long, nodding, deep blue. B.M. 894

(as *Hemerocallis cærulea*.) Mn. 1, p. 73.—The commonest blue-fld. species. *Fúnkia marginàta*, Sieb., is a form with white-bordered lvs. There is also a yellow-variegated form.

lancifòlia, Tratt. (*Fúnkia lancifòlia*, Spreng. *F. japónica*, Hort., of some). Lvs. lanceolate to narrowly ovate-lanceolate, the blade 6 in. or less long and 2 in. or less wide: raceme lax, 6–10-fld., on a tall, slender st.; fls. 1½ in. or less long, the tube slender and gradually enlarging upward, pale lilac. Var. **álbo-marginàta**, Hort. (*Fúnkia álbo-marginàta*, Hook., B.M. 3657),

1910. Hosta cærulea.

has the lvs. edged white. Var. **tardiflòra** (*Fúnkia tardiflòra*, Hort.), blooms in late autumn: lvs. firmer and shorter petioled. Gn. 64, p. 297. Var. **undulàta** (*Fúnkia undulàta*, Otto & Dietr. *F. lancifòlia* var. *undulàta*, Bailey) is a form with undulate white-margined lvs. There is a form with 1-striped lvs., var. **univittàta**, Hort. Graceful. Fls. smaller than those of *H. cærulea*. **H. lóngipes** (*Fúnkia lóngipes*, Franch. & Sav.) is closely allied, but has broader lf.-blades decurrent on the petiole.

H. Aòki, with "large glaucous-green lvs." is advertised. It has been offered in this country from European sources, and is said to be apparently identical with Hosta Sieboldiana, except in time of blooming.—*H. aùrea*, Hort., variegated forms of various species.—*H. elàta*, Hort., "bears tall scapes of pale blue fls."—*H. gigantèa*, Hort., has "long spikes of blue fls."—*H. variegàta*, Hort.=variegated forms of various species, usually of H. cærulea or H. lancifolia.—*H. viridis-marginàta*, Hort., is probably a form of H. cærulea.

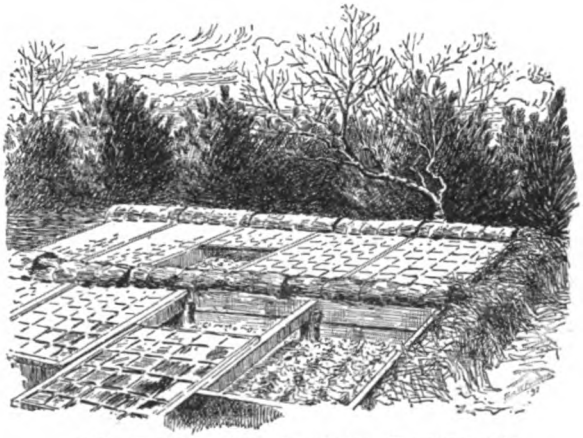
L. H. B.

HOTBEDS. Low glass structures in which plants are started or grown, usually heated by fermenting vegetable substances, such as stable-manure, although fire heat is occasionally applied, steam, hot water and flues being used. Their usual place is some spot sloping to the south, where they are protected by buildings, evergreen screens or board fences, from the north and west winds (Fig. 1911). The frames are made either of plank or boards and may be portable, or built in place, the former being taken down and packed away except when needed. A tight board fence 6 feet high, as a windbreak, is desirable, as it will also serve as a support for the shutters, mats and sash when they are removed from the bed, and it will answer best for this purpose if it inclines a foot or so to the north.

When movable frames (Fig. 1912) are used, they are generally constructed of 2-inch plank, the side pieces being from 9 to 12 feet and the ends 6 feet in length, to receive either three or four ordinary sash, which are 3 by 6 feet. The north side of the frame is made 15 inches wide, while the south side is but 9 or 10 inches, thus giving a slope to the south, which will permit the water to run off and favor the passage of the sun's rays through the glass. The end pieces are 6 feet in length, and in width taper from 15 inches at one end to 9 or 10 at the other, so as to fit the side boards. The plank for portable hotbed frames may be held in place by means of stakes, or iron rods or bolts may be fastened to the ends of the side pieces so that they can pass through the holes in the ends of the frame, which can then be secured by keys or nuts. As supports for the sash and to hold the sides of the frame in place, cross-strips of board 3 inches wide are sunk into the upper edge every 3 feet, and another strip with a width equal to the thickness of the sash is fastened on edge to the center of its side. Frames of this size require a slightly deeper mass of heating material than would be necessary for larger frames, and when they are to be used during the winter, it is well to excavate to the depth of 2½ feet and for a space 2 feet longer and wider than the frame, and after the hole has been filled with heating material, the material should be well tramped down. The frame is then put in place and manure is banked about it.

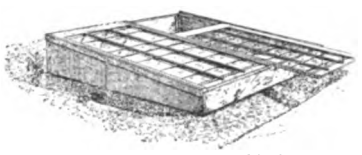
For permanent frames, rough 1-inch boards may be used, although 2-inch plank will be found far more durable. Stout stakes should be driven into the ground about 4 feet apart, where the north line of the bed is to be located. These should project above the surface from 12 to 15 inches, and should be boarded up from a point just below the level of the ground, so that the stakes will be on the north side of the frame. A second row of stakes should then be driven at a distance from the first row equal to the length of the sash, which is usually 6 feet, although other lengths are sometimes used. The south wall of the frame should then be boarded up so that it will be 5 or 6 inches lower than the north wall, after which the end should be closed and cross-pieces should be fitted, the same as for the portable sash. To prevent frost from working into the frame, soil should be taken from the inside and banked against the boards outside, so that it will reach two-thirds of the way to the top of the frame, and when the bed is ready for use, 3 or 4 inches of horse-manure should be spread over this. The frame should be placed about 3 feet from the fence, and if other rows are needed, there should be alleys about 7 feet wide between them.

Instead of boards or planks, concrete may be used for the walls of permanent frames. Forms should be set so that the lower part of the wall will be 4 inches thick but it may be only 2½ or 3 inches on the top. The excavation for the wall should extend about 1 foot below the surface and to prevent the settling of the concrete walls, when the excavation for the bed itself



1911. Hotbed sheltered by a hedge. The straw mats have been rolled off.

is made, concrete piers about 6 inches square should be built every 6 feet for the wall to rest upon. They should extend nearly 2 feet below the wall. The walls of the excavation will serve as a form for the piers and if care is taken in making the excavation for the wall itself, there will be no need of making a form for the outside of the walls below the surface, but plank should be set up for the inside of the walls, and for both sides of the wall above the surface. For making the grout, use four parts of gravel, two parts of sharp sand and one part of cement. Mix the sand and gravel and then after adding and thoroughly mixing the cement, pour on water enough to make a "wet mix." Pour the grout into the form, thoroughly packing it, and then allow the form to remain until it has set.



1912. Hotbed with movable frame.

Hotbed sash.

The size that has been found most satisfactory for hotbed sash is 3 by 6 feet, as when larger than this they are not readily handled by one man. While pine and other native lumber may be used, cypress is generally perferred, as it is much more durable and costs but little if any more than clear pine. The sides and upper ends of the sash are made from 3 by 1½-inch strips, grooved to receive the glass, while the lower end is about 1 by 5 inches. The center strips are 1 by 1½ inches. For glazing hotbed sash, single-strength 10 by 12 glass is commonly used, as three rows of this size will fill a sash 3 feet wide. While double-strength glass will be less easily broken, the increased weight is an objection to its use. The use of double-glazed sash is often advised, but aside from the extra cost, it will be found that the sash will be heavy to handle and, if used near where soft coal is burned, the bottom rows of glass will soon become nearly opaque and it will be necessary to reglaze the sash in order to wash the glass. Where there will be no trouble from soot and the sash is to be used for the covering of half-hardy plants in the winter, double-glazed sash may be used with satisfaction. The sash should receive two coats of paint, and after the glass, which may be either lapped or butted, has been set, it should be given a third coat.

Mats and shutters.

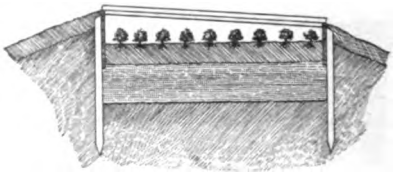
For covering the frames on cold nights during the winter and early spring months, straw mats are often used, although those made of burlap are generally preferred. The burlap may be either single or doubled, or it may be stuffed with straw, excelsior or other materials. Quilted mats filled with combination wool are very warm and quite durable. During the winter, wooden shutters are also desirable to place over the mats, as they assist in holding the heat, and by keeping the mats dry, aid in preserving them.

Heating material for hotbeds.

To provide heat for the beds decomposing horse-manure is generally used. While a large amount of straw is not desirable, the presence of urine-soaked bedding with the manure to the extent of one-third its bulk is not objectionable, as it will lengthen the heating period of the manure. Unless straw is mixed with the manure, it will be well to add forest leaves to the amount of one-third to one-half the amount of the manure. The heating material should be forked over and placed in a pile 5 to 6 feet wide, 3 to 4 feet high and of any desired length. If the manure and straw are dry, it will be well to moisten them with a fine spray. In case there is but a small amount of manure, it will be best to use warm water, though in all cases the soaking of the manure should be avoided. Within four or five days the giving off of steam will indicate that heating has commenced. The pile should then be forked over, working the outer portions into the center.

The amount of heating material that will be required for a hotbed will vary with the crop, as well as with the location and season. For zero weather, there should be at least 18 inches of heating material after it has been well packed down, and 24 inches will be desirable in midwinter in the northern states, while 6 to 8 inches may answer where only a few degrees of frost are expected. For 18 inches of manure, the excavation should be made to a depth of 28 inches below the level of the south side of the frame, and 31 inches below that of the north side. After the manure has warmed through for the second time it should be placed in the excavation, spreading it evenly and packing it down with the fork, but leaving it for a few days before tramping it. Care should be taken to have the corners well filled, that an even settling may be secured. After the manure has again warmed up, it should be thoroughly tramped.

The bed is then ready for the soil, which should be quite rich and contain a large amount of sand and humus, a compost of decomposed pasture sods with one-third their bulk of rotten manure being excellent for the purpose. The thickness of the soil should vary from 5 to 7 inches, the greater depth being desirable for radishes and other root crops (Fig. 1913). When boxes of plants are to be placed in the beds, the depth of soil need not be more than 3 inches. For a few days the bed will be quite warm, but when the temperature of the soil has dropped below 90° the seeds may be sown or the plants set out.

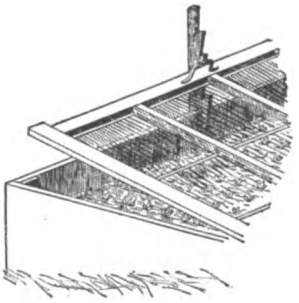


1913. Hotbed in cross-section.

In severe weather the mats and shutters should be placed on the bed at night and should be removed in the morning. When the sun is shining, or if the bed is very hot, it should be ventilated by raising (Fig. 1914) or slipping down (Fig. 1912) the sash, the amount depending upon the season and the condition of the bed. By the middle of the afternoon the sash should be closed and the covering should be replaced before night. When used in the winter time, the hotbed should be either sunk in the ground or well banked up with soil or manure, so as to keep out the frost.

Fire-heated hotbeds.

Especially if the beds are to be used during the winter months, and where there is an abundance of wood for fuel, it is advisable to use artificial heat for hotbeds. The simplest and cheapest method of heating is by means of hot-air flues. These do not differ materially from greenhouse flues except that they run underground and 6-inch sewer-pipe is used for them. The best results are obtained when the beds are built on the slope of a hillside, as this improves the draft. A



1914. Ventilating the hotbed.

small furnace or firebox is constructed of brick or concrete at the lower end of the frames from which one or more lines of hotbeds may be heated. As a rule, it is not best to heat more than two rows of frames from a furnace.

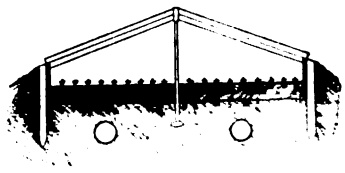
The flues are placed so that they will be 10 or 12 inches below the surface of the soil in the frames and they should rise gradually toward the farther end, where they should be connected with a pipe which will serve as a chimney. The height should vary from 6 to 10 feet, according to the length of the frames. For use in the winter, there should be two flues in a frame 12 feet wide.

When the hotbeds are located near a greenhouse heated by steam or hot water, it will be found satisfactory, particularly if the beds are higher than the heating plant, to put in either hot-water or steam pipes for heating them. While beds 6 feet in width may be heated in this way, it is better to make them about 12 feet wide, with a ridge in the center and a row of hotbed sash on each side. To heat such a frame with hot water, a 2½-inch flow-pipe should be run just under the ridge and there should be one or two 2-inch returns on each of the side walls. For use in the spring, one return on a side would answer, but in the winter months two will be necessary in sections where the mercury reaches zero, unless the beds are covered to prevent the escape of the heat. When steam is used, the feed-pipe should be 1½- or 2-inch and 1¼-inch pipe should be used for the returns.

In the northern states, it is seldom desirable to use hotbeds of any kind for the growing of winter crops, as not only can better results be secured in greenhouses, for which the cost will be but little more, but the work of handling the hotbeds in cold, stormy weather will be very disagreeable and unsatisfactory. In the South, however, hotbeds answer very well for winter use, both for growing plants for the truck-garden and for the forcing of various vegetable crops, although even there the simply constructed greenhouses would be more satisfactory.

Coldframes.

As an adjunct to the greenhouse when one is growing truck-crops, or bedding-plants, a coldframe will be found very helpful. These differ from hotbeds only in relying upon the sun for their heat. The surface of the soil should be from 6 to 12 inches below the glass.



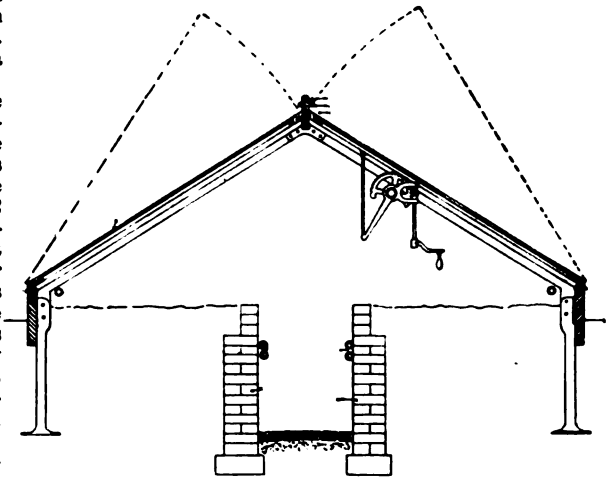
1915. Fire hotbed.

If plants are to be grown in the soil of a frame, care should be taken that it is adapted to the crop and that it is well stored with available plant-food. In many cases the frames are merely used for the hardening of plants which have been grown in the greenhouse, or for the carrying of half-hardy plants through the winter. For these purposes the soil in the frames should be of a sandy or porous nature.

Glass sash should be used for covering the frames in the winter but, in the spring, canvas and other substitutes answer very well, particularly when the frames are to be used for the growing of seedlings. A long strip of canvas may be stretched lengthwise of the bed as a covering at night and upon cold days, and removed in whole or in part in pleasant weather. Oiled paper and water-proofed muslin are also used as substitutes for glass in hotbed sash.

Management of hotbeds.

If the weather is mild during the latter part of February, the manure can be procured and prepared for use so that the hotbed may be started about the first of March. If properly constructed they will provide heat for two months, and can then be used during May as coldframes, thus making it possible to take off two crops in the spring. Although it is not often practised, they may be used in the fall for growing a crop of lettuce or other vegetables, which can be matured before the first of December.



1916. Hotbed or forcing-house heated by hot water.

If a greenhouse is not available for starting the plants, seeds of lettuce, radishes, cabbages and other of the hardier plants may be sown in the hotbed in the spring as soon as it is ready, in rows 4 or 5 inches apart. When the first true leaf appears, the radishes should be thinned and the other plants transplanted to about 2 inches. Later on, the lettuce plants should be placed about 8 inches apart each way. If the weather is so cold that the bed should not be kept open, the seeds may be sown and the first transplanting may be in flats or boxes, which can then be placed in the beds. Aside from proper ventilation, covering and watering, the beds should occasionally be weeded and the soil stirred. About the first of April, tomatoes, cucumbers and similar plants may be started. As soon as one crop is taken off another should be placed in the beds, and by deepening the soil they may be used during the early summer for growing cauliflower, tomatoes and cucumbers.

L. R. TAFT.

HOTÈIA: *Astilbe.*

HOTTÒNIA (Peter Hotton, 1648–1709, professor at Leyden). *Primulàceæ.* FEATHERFOIL. Two species of water plants, perennial, not very ornamental, but suitable for small aquaria.

Plants rooting or floating, the sts. spongy and air-bearing, the peduncles hollow and erect: lvs. submersed and dissected, passing into entire narrow whorled bracts: fls. white or purplish, whorled and racemose, emersed; corolla salverform, with 5-parted limb; ovary free: fr. a globular more or less 5-valved many-seeded caps.—The European species is procurable from dealers in aquatics; the American can be gathered in shallow, stagnant ponds from Mass. to W. N. Y. and south to Fla. and La.

palústris, Linn., the European plant, is an herb with creeping rootstock, whorled leafy branches entirely submerged and alternate, pinnately dissected lvs., the divisions numerous and linear. From the center of the whorl of branches a single leafless fl.-st. rises out of the water in summer, bearing a raceme with several whorls of 3–5 or 6 handsome pale purple fls., apparently with

5 petals, but actually with a short corolla-tube below the lobes; stamens 5, inserted on the tube of the corolla: caps. subglobose, with 5 lateral valves; seeds numerous.—The plants root in the mud or float, and the fls. are about ¾in. diam.

inflàta, Ell., the American plant, has spongy sts. and clustered peduncles, which are partly above water, inflated, jointed, the lowest joint 2–4 in. long and sometimes 1 in. thick, the others 1–3 in number and successively shorter: fls. white in whorls of 2–10 at the joints. B.B. 2:586.—Neither species is advertised. Like all aquarium plants, they are interesting, but they have no horticultural value otherwise. Both plants are called featherfoil and water-violet; the American also water-feather and water-yarrow. The European species has dimorphic fls., after the manner of Primula. The earlier fls. in the American species are cleistogamous.

L. H. B.

HOULLÈTIA (after Houllet, French gardener). *Orchidàceæ.* Epiphytic, pseudobulbous orchids, allied to Stanhopea, and blooming in summer.

Pseudobulbs conical, 1-lvd.: lvs. lanceolate, plicate: sepals and petals usually nearly equal; labellum continuous with the clavate, arcuate column; pollinia 2, on a long caudicle.—About 8 species from S. Amer.

odoratíssima, Lind. Sepals and petals reddish brown; labellum white, with 2 crimson appendages midway of its length. Colombia. G.C. II. 24:777. C.O. 1. Var. **antioquénsis,** André (*H. antioquénsis,* Hort.), has labellum white, tinged yellow. I.H. 17:12.

Brocklehurstiàna, Lindl. Fls. 5–8, about 3 in. across, brownish red, dotted with brown-purple; sepals oblong, obtuse, the lateral ones slightly united at base; petals narrower, obovate; labellum yellow, thickly dotted with brown-purple; from its lower half 2 linear appendages have their origin. Brazil. B.M. 4072. P.M. 9:49. R.H. 1885:492.

pícta, Lind. & Reichb. f. Fls. 6–10; sepals oblong, brownish, unspotted above, tessellated with yellow below; petals similarly colored; labellum yellow, spotted or dotted with brown-purple or red-purple, the end hastate; apex recurved, pale yellow veined with crimson. Colombia. B.M. 6305.

Wállisii, Lind. & Reichb. f. (*H. chrysántha,* Lind. & André). Fls. about 2 in. across; sepals and petals yellow, blotched inside with brown-purple; labellum yellow, dotted with crimson. Colombia. G.C. II. 18:437; III. 50:177. G.M. 54:661. J.H. III. 63:315. I.H. 18:71.

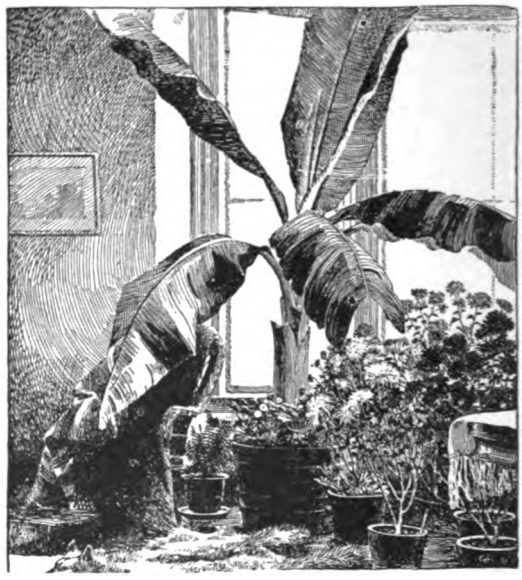
H. Sánderi, Rolfe. Raceme 2–3-fld.; fls. large, pale yellow; sepals about 1¼ in. long, the dorsal elliptic, the lateral broadly ovate; petals broader, nearly orbicular, about as long as sepals. Peru. B.M. 8346.

OAKES AMES.
GEORGE V. NASH.†

HOUSE PLANTS (Figs. 1917–1919) are those plants that can be grown in the ordinary rooms of dwelling-houses. They may be hardy or tender; only such as are suitable for this purpose will be considered here.

In the living-rooms of the modern well-built house, plants must contend against difficulties which did not exist in the less carefully equipped dwellings of fifty years ago or earlier. The present methods of heating and lighting, by gas or kerosene lamps, not electricity, produce a dry atmosphere which is inimical to vegetable growth. In houses lighted by electricity, and heated by any system which introduces fresh air in abundance, the hindrance is not so troublesome. Too much heat and dry air are harder for plants to endure than insufficient light, but it is also lack of light which makes it difficult to grow flowering plants in houses. Dust and insects do harm, but can be checked.

For the above reasons it is important to choose house plants which are adapted to resist a dry atmosphere, a high temperature and inadequate light. Such examples can be found among certain tropical plants with coriaceous leaves and small stomata, what the florists call foliage plants, e. g., rubber trees, palms, and the like. These make the best foundation upon which any successful system of growing plants in houses can be built. Flowering plants can also be used, but they should be introduced from time to time, each in its proper season, when about to bloom or in bloom,



1917. Pot-plants in the window.

and not considered a part of the permanent arrangement. After flowering they should be removed: their function is not unlike the use of cut-flowers, but they last longer and are not more expensive, while they largely increase the attraction of the window-garden.

The best rooms for plants are those which get the most sun, and the best positions are those nearest the windows, where there is not only more light but more fresh air. A large palm, fern or rubber will grow in an entry or poorly lighted corner, but the best place is that which is best lighted. Plants do well in a kitchen, the moisture from the cooking helping them materially; it is by no means a bad hospital for unhealthy specimens.

A conservatory is desirable but not always obtainable on account of the expense; it should agree with the architecture of the house and have the proper aspect. The construction should be durable, the walls and roof low and, a point often neglected, great attention should be paid to ventilation. This should be given not only in the roof, the very apex when possible, but also on the sides at the bottom. The trouble comes in early autumn when the plants are first potted up and again when the sun begins to be hotter in February, March and April. Fresh air should be given all winter on bright days, but it is particularly needed at the times named above. Shade is also advisable on warm sunny days and a system of screens either inside or out can be devised. The florists' method of painting the glass is good but unsightly. When a regular conservatory is unobtainable, a plantroom can sometimes be made which is most satisfactory and at comparatively small cost. It is often possible to utilize a part of the basement for such purpose. A southeast or south exposure is best, but if it faces southwest or even west no trouble follows. Such a room should be well furnished with windows which open both at top and bottom. The floor should be of concrete or porous tile and the walls covered with material which is unharmed by water;

good drainage should be provided. Such a room is not only capable of keeping plants in good condition but can also be used for starting seedlings and cuttings. The temperature can be kept well above freezing and under 50° F. sometimes without extra fire heat when such a room opens into a heated cellar. It can be used not only for growing plants but also as a storeroom from which plants can be taken for decorating the living-rooms; there is no better place for all bulbous plants from the time they are taken out of the frame until they show flower-buds well developed.

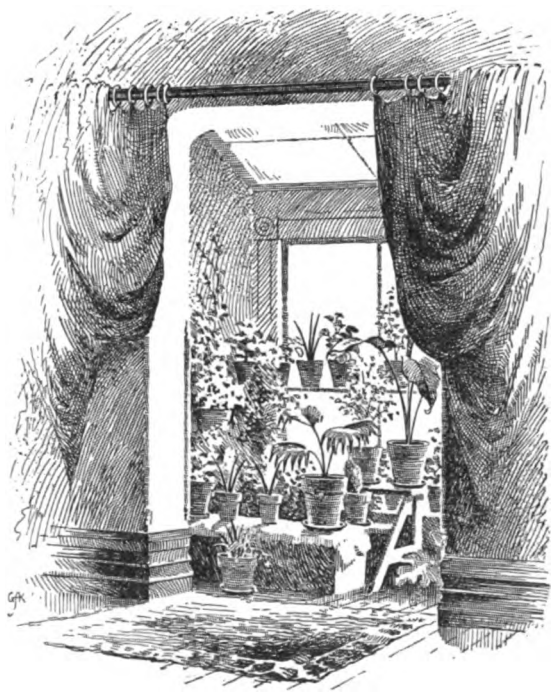
In rooms in which plants are kept, any device by which the atmospheric moisture can be increased is desirable: oilcloth on the floor, or a floor of porous tiles; a zinc tray, in which the pots can be set and surrounded with moss; saucers under the pots, the pots being raised slightly to prevent the roots of the plants standing in the water which runs through. By these aids not only can plenty of water be given to the roots, but there will also be some opportunity to sprinkle the leaves, while the evaporation of surplus water will dampen the air. The Japanese porcelain pots are not only ornamental but useful; the glaze prevents undue evaporation from the sides, and the legs hold the pot well above the water which may collect in the saucer: they are in every way excellent. Wooden tubs are serviceable for large plants or for any which are likely to be exposed to frost, either before or after bringing into the house. Plants should never be overpotted, but the larger the bulk of earth the easier it can be kept uniformly moist; from the wider surface, too, there is more evaporation. For these reasons it is sometimes a good plan to have window-boxes in which several plants can be grown; or the boxes can be filled with moss in which the pots can be plunged. All pots, tubs or boxes for growing plants should have holes in the bottom through which water can pass freely.

Much trouble is likely to come from the use of unsuitable potting soil. Procure it from an experienced florist, or make it yourself of equal parts rotted sods, old leaf-mold, well-decayed cow-manure and clean, sharp sand: discard tea leaves, chip dirt, and the decomposed remains of dead stumps. The soil should always be moist when used, not too wet and never dry: it should be made firm, not hard, and a good space left between the surface and rim. Large pots should be drained with potsherds and moss. The best time for potting is just before the plant begins to grow; the next best is just before growth ceases, thus giving the plant opportunity to establish itself in its new quarters before it stops growing. It is not always easy to do this properly at home, and large and valuable plants should be sent to a florist. Plants growing in the open air should be lifted and potted two weeks or more before bringing into the house, not only before frost but before the nights are cool. Keep them at first in a shady place, gradually accustom them to the sunlight, and carefully avoid all drafts. Do not give too much water at the root: some wilting is unavoidable, and cannot be prevented by heavy watering. Give one good application when they are first potted, and sprinkle the foliage and surroundings in the middle of the day. After they are established, keep them out-of-doors, on the piazza or porch, until there is danger of frost, but try to bring them into the house before the furnace fires are lighted.

A period of rest is natural to all plants. Amateurs often make mistakes in trying to force plants to grow all winter in the house after a vigorous growth in the open ground all summer. Such plants should be rested, kept cool at first and water withheld, but never to such an extent as to shrivel the wood. No rules can be given for watering, the most important detail of plant-growing. Water must be given as it is required, a knowledge to be gained from experience only. This may be once a day or once a week, twice a day or once in two days. The smaller the pot and the more vigorous the growth, the oftener it will be required. In hot weather and in dry rooms more water is needed than in cool rooms and on damp, cloudy days. It should always be given in sufficient quantity to pass through the hole in the bottom of the pot: here it can remain an hour or more, and part of it will soak up, back into the pot, but the surplus should be taken away with a sponge, unless the pot has legs or it is a plant like calla, English ivy, or some ferns, which are uninjured by an over-supply. Water given to the foliage of house plants in the form of spray is always helpful.

Insects, dust and sometimes fungous pests are troublesome to house plants, due largely to insufficient watering and lack of ventilation. The best remedy is frequent washings with warm water and a sponge for plants with large leaves. All plants can be easily cleaned at the kitchen sink or in the bathtub, or advantage can be taken of a mild day, and the work done in the yard with the hose. The forcible application of water will remove most insects, but if scale appears it must be taken off with a stiff brush. Whale-oil and tobacco soap are too rank for house use; fir-tree oil and Gishurst's compound are less obnoxious. They can be used when the plants are washed with sponge or brush. The florists' preventive against greenfly is impracticable: enough tobacco smoke to harm them would not be tolerated in living-rooms. Tobacco stems may be burned, however, in the plantroom described above if a well-fitted door is provided and precautions are taken to make the ceiling air-tight. It is altogether too dangerous to use cyanide of potassium in any form of plant-growing in the house. The red-spider can be driven off by spraying with an atomizer, if discovered in time. Some plants are not attacked by insects, but are injured by dust, e.g., the rubber-tree. Dusting when dry is better than nothing, but washing is best. If fungous diseases appear, the plants should be isolated, giving a chance to recover, or be thrown away.

Ventilation is an important factor in keeping house plants in good condition. Open the windows on bright days: the fresh air is moist and therefore grateful, and will do no harm, even if the plants are near the glass, so long as the sun shines and discretion is exercised.



1918. A window-garden.

The night temperature need never exceed 50° F., and a drop of 5° or even 10° is not likely to do any harm. Precautions must be taken to exclude frost; the blinds must be shut and the curtains pulled down on cold nights. A layer of newspapers between the plants and the windows is a protection in extremely bad weather, or a large kerosene lamp can be allowed to burn all night near the plants.

A list of suitable foliage plants for the house: *Ficus elastica*, the rubber plant; *F. religiosa* (peepul tree) and most of the other strong-growing evergreen species. *Livistona sinensis*, *Corypha australis*, *Chamærops Fortunei* and *Rhapis japonica*, all good fan-palms (the first is the best); *Phœnix reclinata*, *P. rupicola* and *P. canariensis* are the best date-palms. *Seaforthia elegans*, *Howea Belmoreana*, *Kentia Forsteriana*, *Areca Baueri*, *A. rubra* and *Cocos Weddeliana* are all good palms, but require more care and heat than the fan- and date-palms. *Cycas revoluta* (sago-palm), *Curculigo recurvata*, *Aspidistra lurida*, *Pandanus utilis* (screw pine), *P. Veitchii*, *Phormium tenax* (New Zealand flax), *Cyperus alternifolius*, *Papyrus antiquorum*, Cordyline, Dracæna, *Agave americana* (century plant), Pittosporum, *Grevillea robusta*, English ivy, wandering jew and some species of cactus all do well in ordinary rooms. *Daphne odora*, laurestinus, *Olea fragrans* and orange trees are both flowering and foliage plants, but require a cooler room than any of the preceding varieties.

Good flowering plants are *Azalea indica* and *Camellia japonica*, both of which should be kept in a cool room when not in bloom. Calla and begonia both do well. Chrysanthemums, cinerarias, gloxinias, gladioli, cyclamens, Chinese and English primroses, freesia, oxalis, fuchsia, mahernia, euphorbia, heliotrope, pelargonium and lily-of-the-valley can be brought into the rooms when in flower, and last a reasonable time in good condition. Hyacinths, tulips, narcissi and crocus, if potted in October, kept covered up out-of-doors until cold weather, stored in a cool cellar until the middle of January and then brought into warm rooms, will give flowers: a succession can be maintained by bringing them into warmth at intervals. (See *Bulb*.)

The following varieties of hyacinths and tulips are particularly recommended for growing in living-rooms under ordinary circumstances:

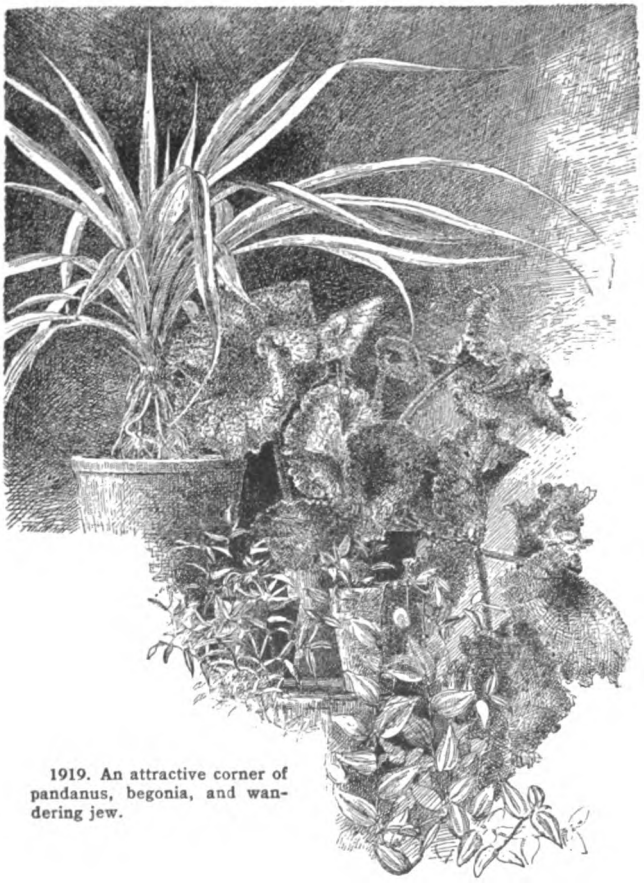
Hyacinths.—The single sorts are much better than the double and more easily handled. Single reds and pinks: Gen. Pelissier, Gigantea, King of the Belgians, La Victoire, Norma. Single white: La Grandesse, L'Innocence, Madame Van der Hoop, Mr. Plimsoll. Single blue: Czar Peter, Enchantress, Grand Lilas, King of the Blues, Lord Derby, Queen of the Blues. Double red: Grootvorst, Lord Wellington, Noble par Merite. Double white: Isabella, La Grandesse. Double blue: Bloksberg, Garrick, Van Speyk. Double yellow: Goethe.

Tulips, early single.—Albion (White Hawk), white. Belle Alliance (Waterloo), red. Couleur Cardinal, bronze-red. Cramoisi Brillant, bright scarlet. Goldfinch, yellow. Keizerkroon, red and yellow. La Reine, white turning pink. Mon Tresor, yellow. Pottebakker, scarlet. Primrose Queen, sulfur-yellow. Prince of Austria, orange-red. Proserpine, carmine. Rose Grisde Lin, pink. Rose Luisante, deep pink. Thomas Moore, orange. Vermilion Brilliant, scarlet. Yellow Prince, yellow.

Tulips, double.—Couronne d'Or, yellow flushed red. Imperator rubrorum, red. Murillo, best light pink. Salvator Rosa, deep pink. Tournesol, yellow.

All the Duc Van Thol tulips are excellent for early forcing, particularly the scarlet. The Darwin tulips are now sometimes forced, but they are not suitable for growing in houses. The Parrot Cottage tulips and the like are not grown in this way.

Roman hyacinths are easily forced and with the Paper White narcissus can be flowered between Thanksgiving and Christmas. Narcissus Campernelle var. rugulosus, the Chinese sacred narcissus, the double Roman, and most varieties of Polyanthus narcissus flower earlier than the other sorts. B. M. Watson.



1919. An attractive corner of pandanus, begonia, and wandering jew.

HOUSTÒNIA (Dr. Wm. Houston, who collected in the West Indies and Mexico, died 1733 in Jamaica). *Rubiàceæ*. About twenty-five North American small herbs or rarely subshrubs, with pretty white, blue or purple flowers, some of the species cultivated in wild gardens and rockeries.

Plants usually tufted or growing in colonies: lvs. small, opposite, on the slender sts: parts of the fls. in 4's, the corolla gamopetalous and funnelform or salverform; stamens and styles polymorphous; stigmas 2: caps. opening near the top, partly superior.—The species are native on the Atlantic side of the continent and in Mex. Some of the small herbaceous species are sometimes transferred to cult. grounds, although the kinds are little known as horticultural subjects. A moist, partly shaded place is to be recommended for most houstonias, because their flowering season is thereby prolonged and the plants retain their foliage much longer than in a drier and sunny position. Collected plants are not difficult to establish. Prop. by division. The following perennial species have been offered by American dealers:

A. *Plant tall (4–18 in.): peduncles many-fld.*

purpùrea, Linn. Tufted, 3–18 in. high, bearing offsets, glabrous or pubescent: radical lvs. round-ovate or oblong to lanceolate, short-stalked: fls. in late spring or summer, the corolla funnelform, purple; calyx-lobes exceeding the half-free caps. Md. and Iowa to Texas.

AA. *Plant lower (1–6 in.): peduncles 1-fld.*

cærùlea, Linn. BLUETS. INNOCENCE. QUAKER LADY. Fig. 1920. Little tufted perennials, 3–6 in. high, the sts. glabrous: radical lvs. spatulate to obovate, hairy, short-petioled, the st.-lvs. small: corolla salverform, the tube much exceeding the calyx-lobes, varying from blue to white, with a yellow eye. B.M. 370. Gn.W. 20:868. —Charming little plant in grassy places in the northeastern states and southward in the Alleghany region; early spring. Excellent for rockwork and grassy borders. In gardens, may be treated as annual or biennial.

serpyllifòlia, Michx. Prostrate and extensively creeping: radical lvs. orbicular to ovate-spatulate and abruptly petioled: corolla rather larger than that of *H. cærulea,* deep violet-blue (often white). Pa., southward. G.W. 12, p. 151.—Early spring. L. H. B.†

HOÛTTEA: *Vanhouttea.*

HOUTTUŶNIA (M. Houttuyn, of Amsterdam, writer on natural history in 1774–1783). *Saururàceæ.* One oriental species, the Californian species being now referred to Anemopsis (p. 287, Vol. I). *H. cordàta,* Thunb., is a perennial herb, growing ½–3 ft. high, from a creeping rootstock, from Himalaya to China and Japan: st. leafy, nearly simple, angular: lvs. alternate, simple, broadly ovate-cordate, 5-nerved: fls. very small, naked, in a short spike; stamens 3; short spike subtended by a corolla-like spathe in 4 ovate spreading white parts. B.M. 2731. G.W. 11, p. 385.—Grows in ditches along waysides, up to 5,000 ft. in India. Perhaps to be recommended for moist places in mild climates. L. H. B.

HÒVEA (probably A. P. Hove, Polish botanist). Syn. *Poirétia. Leguminòsæ.* Ornamental, unarmed or seldom thorny, greenhouse shrubs: lvs. alternate, simple, entire or prickly-toothed, glabrous above, often tomentose beneath; stipules setaceous, minute or none: fls. blue or purple, in axillary clusters or very short racemes or rarely solitary; upper lobes of calyx united into a broad, truncate upper lip, the 3 lower ones much smaller, lanceolate; petals clawed; standard nearly orbicular, emarginate: pod sessile or stipitate, the valves at length entirely spreading.—Eleven species, confined to Austral. Best prop. by seeds sown in spring in well-drained pots of sandy peat and placed over a gentle bottom heat. When 2–3 in. high, the points should be pinched out to induce a bushy habit. After they are established, grow in a cool greenhouse with plenty of air. **H. Célsii,** Bonpl. (*H. elliptica,* DC.). A tall shrub, sometimes 8–10 ft. high: lvs. ovate-elliptical to narrow-lanceolate: fls. blue, in clusters or short racemes, the pedicels often as long as or longer than the calyx. B.R. 280. B.M. 2005. L.B.C. 15:1488. Gn. 59, p. 178, desc.; 75, p. 225. L. H. B.

HOVÈNIA (after David Hoven, Senator of Amsterdam). *Rhamnàceæ.* Ornamental shrub or small tree, grown chiefly for its handsome foliage.

Leaves deciduous, alternate, without stipules, long-petioled: fls. in axillary and terminal racemes; calyx-lobes, petals and stamens 5, style 3-parted: fr. 3-celled and 3-seeded, indehiscent.—One species in Japan, China and Himalayas.

Hovenia has greenish inconspicuous flowers in axillary peduncled cymes, and small globular fruits on reddish, fleshy and edible peduncles. It grows into a small round-headed tree, with handsome somewhat shining foliage. It thrives best in sandy loam and has proved fairly hardy in favorable positions at the Arnold Arboretum. Propagation is by seeds, also by root-cuttings and cuttings of ripened wood under glass.

dúlcis, Thunb. (*H. acérba,* Lindl. *H. inæquàlis,* DC.). JAPANESE RAISIN TREE. To 30 ft.: lvs. cordate-ovate or ovate-acuminate, serrate, sometimes nearly entire, almost glabrous or pubescent on the veins beneath, 4–6 in. long: cymes many-fld. Japan, China, Himalayas. S.Z. 73, 74. B.M. 2360. B.R. 501. S.I.F. 2:47. A.G. 12:80. ALFRED REHDER.

1920. Houstonia cærulea.

HÓWEA (named for Lord Howe's Island, where these 2 species grow). Also written *Howeia. Palmàceæ,* tribe *Arèceæ.* Erect spineless palms known to the trade as kentias, and certainly ranking among the six most popular palms for house culture.

Caudex stout, ringed: lvs. terminal, numerous, dense, equally pinnatisect; segms. narrow, acuminate: spadices 2–3 ft. long, solitary or 3–5 from 1 spathe, thick, cylindrical, nodding or pendulous; peduncle long, compressed at the base; spathe solitary, as long as the spadix, cylindrical, 2-keeled toward the apex, longitudinally split: bracts bordering the channels; bractlets scaly: fls. sunk in the deep furrows of the spadix, the staminate nearly an inch long: fr. 1½ in. long, olive-shaped.

They have the habit of Kentia, but their flowers differ widely. Howea belongs to a subtribe in which the flowers in each spadix are attached to the stem between the bases of opposite leaves, while Kentia belongs to another subtribe in which the flowers are attached at a lower point. Also Howea has symmetrical staminate flowers with rotund sepals, while in Kentia the staminate flowers are not symmetrical, the sepals being small and acute. Howea's nearest cultivated ally is Linospadix, from which it is distinguished by the following characters: staminate flowers with very numerous stamens, the anthers erect and fastened at the base; pistillate flowers with no staminodes; ovule erect. *H. Belmoreana* is the more popular and, as a house plant may be readily told from *H. Forsteriana* by the more ascending position of its leaf-segments, as in Fig. 1921; the leaves of *H. Forsteriana* are more flat or the sides pendent.

The two species of this genus are beyond a doubt the most popular and also the most satisfactory palms in the trade for decorative work in general, and in consequence of the great and growing demand are grown by tens of thousands in the large nurseries. There does not seem to be any record of either of these species having borne fruit in cultivation in this country, and the trade, therefore, depends on imported seeds, which are gathered in immense quantities on Lord Howe's Island, usually shipped from thence to Sydney, New South

Wales, and from the latter port to either London or New York. This long voyage is a severe test of the vitality of such seeds, and frequently results in faulty germination, the average of germination seldom exceeding 50 per cent, and is often much less. Two heavy shipments of Howea seeds are made each year, the first installment arriving in February or March, and the second in September or October. Many growers favor the autumn shipment of these seeds as giving the best results. The seeds should be sown at once on their arrival, the practice followed by large growers being that of broadcasting the seeds on a side-bench in a warm greenhouse on 2 to 3 inches of light soil, then covering them with 1 inch of the same compost, watering liberally and keeping up a bottom heat of about 80°. Under such treatment some of the seeds may germinate in two months, but others in the same lot may not start for eight or nine months, from which it will be seen that the operation extends over a considerable period of time. The seedlings should be potted into

1921. Howea Belmoreana, one of the most popular palms.

small pots when the first leaf is expanded, kept moist and given a night temperature of 65°, the greenhouse in which they are placed being moderately shaded. In three to four months the young plants should be ready for shifting into 3-inch pots if properly cared for; from this time forward they do not require a higher night temperature than 60°. The howeas are not very particular in regard to soil, a rich, light loam answering very well for them, but a very stiff soil may be improved by the addition of one-fourth part of peat, and in all cases a reasonable proportion of fertilizers may be used to advantage. Scale insects are the most troublesome the grower has to contend with, and should be removed as rapidly as possible, else the foliage will be permanently disfigured. Of the two species referred to, *H. Belmoreana* is perhaps the greater favorite, being more compact in growth and extremely graceful in foliage, a plant of this species of a given age usually carrying a greater number of leaves than one of *H. Forsteriana* of the same age, and the leaves having more leaflets than those of the latter species. The seeds of the two species are very similar in appearance, though those of *H. Belmoreana* frequently average a larger size, and while those of the last-named species require about three years to mature on the tree, the seeds of *H. Forsteriana* ripen in about twelve months. For house culture by amateurs, see *Palms*. (W. H. Taplin.)

Belmoreàna, Becc. (*Kéntia Belmoreàna*, F. Muell. *Grisebáchia Belmoreàna*, H. Wendl. & Drude). Curly Palm. Fig. 1921. Described and distinguished above. B.M. 7018. R.H. 1897:256 and p. 257. G.C. III. 8:75. I.H. 21:191. A.G. 13:141; 16:345. Mn. 9:25. Gn.M. 6:288. Var. **variegàta,** Hort. Advertised 1895.

Forsteriàna, Becc. (*Kéntia Forsteriàna*, F. Muell. *Grisebáchia Forsteriàna*, H. Wendl. & Drude). Flat or Thatch-leaf Palm. G.C. III. 8:75, 533. S.H. 2:53. A.G. 16:346. A.F. 4:565; 14:701. G. 8:581. Gn. 73, p. 111. Gn. M. 6:289.

N. Taylor.†

HÓYA (Thomas Hoy was once gardener to the Duke of Northumberland). *Asclepiadàceæ*. Tropical climbing or trailing evergreen shrubs, bearing thick, opposite leaves and odd, often showy flowers in umbel-like clusters, grown under glass and one of them sometimes in window-gardens.

Corolla rotate, 5-lobed, thick and more or less waxy in appearance: crown rotate, of 5 thick and compressed fleshy appendages: pollen-masses short, fixed by their base in pairs to the 5 glands of the stigma: follicles acuminate, smooth: sts. twining, or climbing by means of roots. — Species perhaps 100, E. Asia to Austral.; difficult to determine in herbarium specimens.

Hoyas are summer-blooming plants, of comparatively easy culture. They need an intermediate or warm temperature. Let them rest or remain very slow in winter (50° in a dryish place), but start them into growth toward spring. In the summer they are sometimes plunged in the border, but better results are to be expected, as a rule, by keeping them in pots in the conservatory. In their growing and blooming season, give plenty of sun and air. They propagate by cuttings of the top-growth in spring, and also by layering. The latter method is particularly adaptable to *H. carnosa* and other species that climb by means of roots. The only species commonly known is *H. carnosa*.

A. *Plant distinctly climbing.*

carnòsa, R. Br. (*H. Motóskei*, Teijsm.). Wax-Plant. Twiner, and attaching itself to support by means of roots; ordinarily grown as a pot- or tub-plant, and reaching 5–8 ft. high, but growing twice and more this height when it has the opportunity: glabrous: lvs. succulent and shining, ovate-oblong, acute, short-stalked, entire: fls. white with pink center, fragrant, in axillary or inter-petiolar umbels, the crown-segms. very convex, and spreading into a horizontal star. S. China and Austral. B.M. 788 (as *Asclepias carnosa*). Gn. 69, p. 119. G. 25:123. A.G. 18:34. — The common species, and often seen in window-gardens. After the bloom is over (in summer) keep the plant in a cool place, that it may remain half-dormant. In late winter or spring, start it into growth. Do not cut off the spur which remains after the fls. pass, for this spur bears fls. again. The wax-plant is easy to manage, and it improves with age. Often trained as a permanent cover for a glasshouse wall. The chief drawback is the attacks of mealy-bug, but they may be kept off with a fine stream of water from the hose, and by handwork. In the South, it is nearly everblooming. There is a form (var. *variegàta*) with handsome variegated lvs. Lowe 44.

globulòsa, Hook. f. Hairy: lvs. elliptic-oblong or long-oblong, acuminate, rounded at the base, the midrib very stout, the petiole an inch or less long: fls. pale straw- or cream-color, the star-like crown-segms. white, with pink at the base, borne in dense, globular umbels: follicles a foot or more long. Sikkim. F.M. 1880:406.

G.C. II. 17:741.—A handsome species, requiring the general treatment given to *H. carnosa*.

austrālis, R. Br. Twiner, glabrous and succulent, apparently sometimes epiphytic: lvs. ovate, obovate to nearly orbicular, obtuse or short-acuminate, thick and fleshy: fls. white tinged pink, in simple umbels on peduncles that seldom surpass the petioles; corolla spreading, ½in. or less in diam., broadly 5-lobed; crown cup-shaped and expanding into horizontal concave prominently 2-keeled parts. Austral.

multiflōra, Blume (*H. coriàcea*, Lindl., not Blume. *Cyrtocèras multiflòrum*, Heynh. *C. floribúndum*, Maund. *Centrostémma multiflòrum*, Decne. *C. Lindleyànum*, Decne.). Stout and glabrous, climbing: lvs. linear-oblong, acute at both ends, the petiole short: fls. straw-yellow (corolla white tipped with buff), in many-fld. terminal and axillary umbels on peduncles 1–2 in. long; corolla-lobes ¾in. or less long; corolla-tube bearded at base; segms. of crown entire on inner angles. Malacca, etc. B.R. 25:18. B.M. 5173.

imperiālis, Lindl. Lofty climber, with puberulent sts. and foliage: lvs. elliptic or linear-oblong, obtuse but with a short point: fls. immense (2–3 in. across), leathery, dull purple, somewhat pubescent near the white crown, the segms. triangular-acute: umbels drooping on long peduncles: follicles 9 in. long. E. Indies. B.M. 4397. F.S. 4:393, 394. R.H. 1900:576. J.H. III. 55:443. G. 7:607.—A noble hoya, requiring very rich soil and a rather high temperature. Although naturally a very tall climber, it can be made to flower in pots when 3 or 4 ft. high.

AA. *Plant trailing or nearly erect.*

bélla, Hook. (*H. Páxtoni*, Hort.). Slender, bushy, 1–2 ft. high, pubescent: lvs. an inch long, ovate-acute, very short-stalked, somewhat recurved: fls. ¾in. across, pure white, with very short and half-acute lobes, the crown-segms. boat-shaped and violet: umbels few-fld. and short-stalked. India. B.M. 4402. F.S. 4:399. J.H. III. 35:5. Gn.W. 4:793; 22. suppl. July 1.—Handsome little species; scarcely climbing.

H. campanulàta, Blume=Physostelma.—*H. fratérna*, Blume. Climbing, rooting near insertion of petioles: lvs. 6–12 in. long, very thick, elliptic, glossy above and pale beneath: fls. brownish red, in dense umbels; corolla rotate, pale buff with 5 red-brown blotches; lobes of crown round-ovate, concave with blood-red spot at base. Java. B.M. 4684. J.F. 4:385.—*H. fúsco-marginàta*, N. E. Br. Lvs. fleshy, ovate-lanceolate, 7–9 in. long, tawny on margins: fls. ochre-yellow to yellowish green, in many-fld. umbels on peduncles 2 in. or less long. Country unknown.—*H. ovalifòlia*, Wight & Arn. Slender, glabrous: lvs. more or less clustered, variable, being elliptic to ovate or lanceolate: fls. bright yellow with red corona, in large umbels. India. J.F. 1:64.—*H. pállida*, Lindl.=*H. parasítica*, Wall. (H. pallida, Lindl.). Tall climber: lvs. fleshy, variable, ovate-elliptic to lanceolate: fls. pale yellow or straw-color, the corona pinkish. India. B.R. 951. J.F. 1, p. 64.—*H. purpùreo-fúsca*, Hook. Twining, glabrous: lvs. ovate and acute: fls. purplish brown, in dense umbels; corolla rotate, pubescent above; crown-lobes ovate, nearly plane above. B.M. 4520. J.F. 1:30.

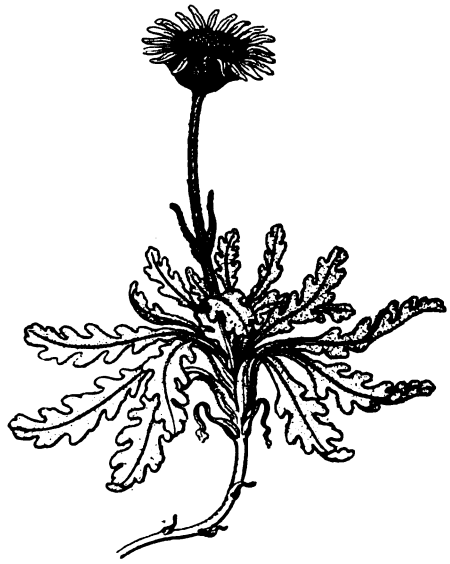
L. H. B.

HUCKLEBERRY: *Vaccinium* and *Blueberry;* also *Gaylussacia.*

HUDSÒNIA (for William Hudson, 1730–1793, an English botanist). *Cistàceæ.* Beach Heather. Three little heath-like shrubs of eastern North America, suitable for colonizing in dry places and along the seashore: low and diffusely branched, with narrow or scale-like or awl-like often closely pressed lvs.: fls. many and small, yellow, crowded on the upper parts of the branches; petals 5, obovate-oblong, exceeding the calyx; stamens many: fr. a 3-valved caps, included in the calyx. Allied to Helianthemum, but differing chiefly in the 2-ovuled cells of the ovary and in the scale-like or subulate imbricate lvs. *H. tomentòsa*, Nutt., on shores and dunes, and in pine-lands, New Bruns. to N. C. and far westward: lvs. oval to narrow-oblong, closely imbricated: fls. nearly or quite sessile: densely tufted, hoary, 4–8 in. high. May–July. *H. ericoìdes*, Linn., in sands and pine-lands near the coast, Newfoundland to N. C.: greenish, although downy: lvs. subulate and spreading: fls. on slender pedicels; at least 1 sepal with tooth near apex: 4 to 8 in. L.B.C. 2:192. *H. montàna*, Nutt., in mountains of N. C.: bushy and somewhat villous: lvs. narrow-subulate, somewhat spreading with age: fls. on slender pedicels; at least 1 sepal with linear-subulate lobe: tufted, the branches 4–6 in. long. They are hardy N. and handsome when covered with their bright yellow numerous fls., but very rarely cult., as they are difficult to grow and short-lived. The first species is a seashore plant and demands very sandy moderately moist soil; the second grows in dry sandy soil. Prop. by seeds and probably by cuttings.

Alfred Rehder.
L. H. B.

HUÉRNIA (Justus Huernius, or Heurnius, collector of Cape plants). Also spelled *Heurnia*. *Asclepiadàceæ.* Succulent dwarf perennials resembling Stapelia, but differing in having the angles between the corolla-lobes produced into teeth, the corolla campanulate, the corona toothed or lobed and adnate to base of corolla. They are greenhouse subjects, mostly from the Cape,



1922. Hulsea nana. (×½)

but some from Trop. Afr. and one from Arabia. They appear not to be in the trade, but some of the 30 or more species may be found in collections of succulents.

HUERNIÓPSIS (*Huernia-like*). Also spelled *Heurniopsis*. *Asclepiadàceæ.* One species, *H. decípiens*, N. E. Br., in S. W. Trop. Afr., differing from Huernia in having no outer corona and in other characters. It is a small succulent with decumbent more or less clavate obtusely 4-angled toothed sts. 1–3 in. long: fls. 2–3 together at the middle or toward the top of the st., 1 in. diam. when expanded, outside pale yellow-green spotted and streaked purple, inside brown-red spotted yellow, fetid at night.

HÚLSEA (Dr. G. W. Hulse, of Louisiana, who collected in California). *Compósitæ.* Perennial, biennial or annual herbs native of California, Nevada and north.

Glandular pubescent or woolly herbs: lvs. pinnately lobed or toothed: fls. large, solitary, yellow or purple; involucral bracts free, narrow; style-branches obtuse; pappus of 4 hyaline, lacerated, chaffy scales.—Eleven species. This includes one of many woolly herbs offered by Californian collectors. It grows a few inches high and bears fls. with yellow rays. Treated best as a partial alpine.

nàna, Gray. Fig. 1922 (adapted from Pacific R. R. Report). Sts. depressed, leafy at summit, sticky-hairy: lvs. pinnatifid or incised; petiole long-margined: peduncle 1–2 in. long; involucral scales in 2 series; rays 20–30. Calif., north. N. TAYLOR.†

HUMÀTA (Latin, *of the earth;* referring to the creeping habit of the rhizomes). *Polypodiàceæ.* Ferns of small stature related to Davallia and sometimes included with that genus, with small, thick, deltoid lvs., with the indusium tough, suborbicular or reniform, attached by a broad base and free at the apex and sides.—Some 20 species are known, mostly from the E. Indies. For cult., see *Davallia.*

Tyermannii, Moore (*Davállia Tyermannii,* Baker). BEAR'S-FOOT FERN. Rootstock wide-creeping, densely covered with linear white scales: lvs. 4–6 in. long, deltoid, 3–4-pinnatifid; lower pinnæ largest, the lowest pinnules cuneate-oblong or deltoid; sori at the base of the ultimate lobes less than a line broad. Cent. China. G.C. 1871:871.

H. heterophýlla, Smith. (Davallia **angustata,** Wallich.). A small creeping plant with long slender rhizomes and simple entire or slightly lobed lvs. 3–6 in. long, 1 in. broad; fertile lf. narrower, with deep sinuate clefts along the sides. Malaya and Polynesia. —*H. rèpens,* Diels (Davallia alpina, Blume). Small plant: lvs. dimorphic, the sterile 1-pinnate, the pinnæ divided into many small segms.; fertile lvs. reduced nearly to the rachis and midveins of the pinnæ; sori borne on spine-like branches of the latter. E. Asia. L. M. UNDERWOOD.

HÙMEA (after Lady Hume). *Compósitæ.* Herbs or shrubs, one of the most popular of which is a half-hardy biennial Australian plant, growing 5 or 6 feet high, cultivated for the grass-like beauty of its large, loose, much-branched, drooping panicles.

Flowers exclusively tubular and hermaphrodite, 1–4 in a small head; involucre narrow, with scarious or petaloid, non-radiating bracts. Three, at any rate, of the 4 other species are shrubs, with fls. in dense corymbs and involucral bracts rigid or petal-like, while in *H. elegans* the bracts are thin and scarious. The genus has no near allies of garden value. It belongs to a group of 6 Australian genera which have no pappus. Humea has nothing of the typical beauty of the common garden composites, since it has no rays, but the common species is a striking plant.

Sow seed from July 1 to September 1. Keep young plants during winter in very cool house in preference to frames, in northern latitudes, on account of losing so much foliage through damping. In spring, or when signs of growth are taking place, repot into larger pots, using a good, rich loam, which has had plenty of manure. They are gross feeders and growers, requiring plenty of water and good feeding. Good plants in 10-inch pots are very ornamental for conservatory or piazza work. The young plants need plenty of light and air, and should be kept nearly dry during the winter. In spring they should be started into growth gradually, and successively repotted until an 8-inch pot is needed. They should not be syringed except when growing rapidly in warm weather. In June the plants can be placed in a subtropical bed that is shielded from high winds, and staked. The foliage has a peculiar and agreeable scent. (A. P. Meredith.)

élegans, Smith. Lower lvs. ovate-lanceolate or oblong, acuminate: st. clasping or decurrent, 6–10 in. long, wrinkled: fls. variously described as brownish red, pink, ruby-red and rose, very numerous, in long loose, gracefully pendulous panicles, much overtopping the rest of the plant. R.H. 1862, pp. 9, 10; 1895, p. 459. S.H. 1, p. 154. *H. álbida,* Hort., is presumably a whitish-fld. form of this species, and should therefore be called var. **álbida.** Var. **gigantèa,** Hort. Much taller than type, reaching 20 ft. in height, having larger lvs. and panicles. The species itself is said by Bentham to attain 5 or 6 ft. or more in Austral. N. TAYLOR.†

HÙMULUS (Latin name, of doubtful origin). *Moràceæ.* HOP. Two twining vines, with rough, opposite, palmately lobed or divided leaves, grown for ornament and one also for "hops."

Dicœcious, the fls. in axillary clusters; staminate fls. with 5 erect stamens and 5-parted calyx, in little drooping tassel-like racemes; pistillate fls. with an entire calyx or perianth closely investing the ovary, which bears 2 long stigmas, the fls. in pairs under large overlapping bracts, the whole making a cone-like catkin which, when becoming very large, is a "hop."—One species in N. Amer. and Eurasia, and one in Japan and Manchuria.

A. *Plant bearing hops,—the pistillate catkin greatly enlarging in fr.*

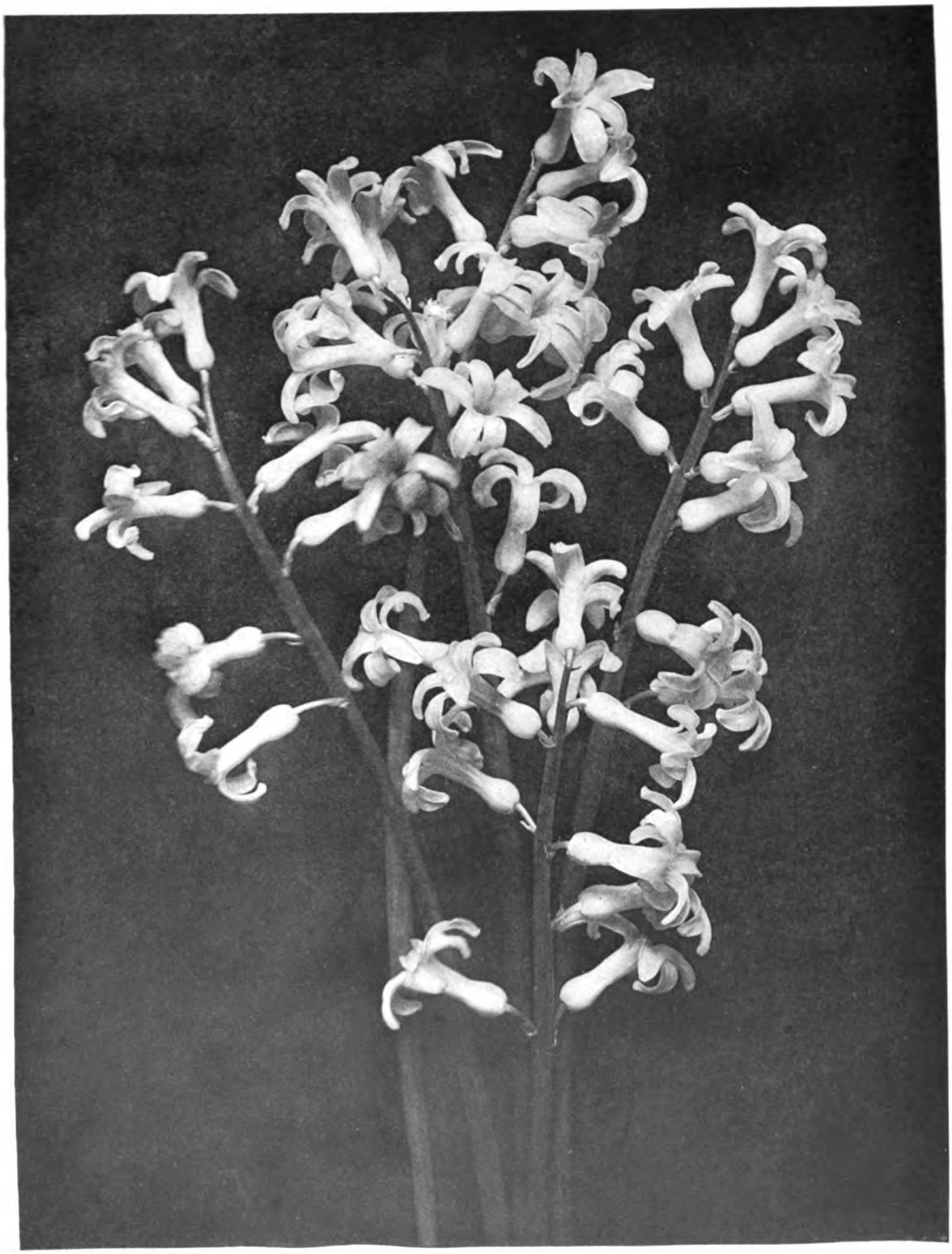
Lùpulus, Linn. COMMON HOP. Perennial herb: shoots often grow 25–30 ft. long in the season: rough-hairy: lvs. ovate or orbicular-ovate in general outline, deeply 3-lobed (sometimes 5–7-lobed), or the upper ones not lobed, margins strongly and uniformly dentate, petioles long: staminate fls. in panicles 2–6 in. long: hops (mature pistillate catkins) oblong or ovoid, loose and papery, straw-yellow, often 2 in. or more long, glandular and odoriferous.—Native along rivers and in thickets in the northern states and Canada, and southward in the Alleghanies and Rockies; occurs as far south as Fla. and Ariz. Much cult. for "hops," used in brewing, and extensively run wild from cult. plants. The hop makes an excellent arbor or screen plant. Var. **aûreus** has yellow foliage. G.W. 10, p. 501. The hop grows readily from cuttings of the shoots, which spring from the crown; also by seeds, but the latter do not reproduce the particular varieties or strains. As a field crop, the hop is not a horticultural subject, and is not discussed here. See Cyclo. Amer. Agric., Vol. II, p. 380. The Rocky Mt. form, common in Colo. and New Mex., has been separated as var. **nèo-mexicànus,** Nels. & Ckll., and it is in the trade: it has more deeply divided lvs. and more sharply acuminate bracts than the ordinary hop; lf.-segms. from broad-lanceolate to nearly linear, acuminate, with resin particles on the lower surface.

AA. *Plant not bearing hops,—the pistillate catkin not greatly enlarging in fr.*

japónicus, Sieb. & Zucc. Annual (or at least treated as such): foliage very like the last, but usually more deeply cut and not less than 5-lobed: catkins not glandular. Japan, China (perhaps intro.) Manchuria; somewhat run wild from cult. in this country. G.C. II. 24:716.—Intro. to general cult. in 1886, and now one of the most popular climbing herbs. It is a very quick grower, plants 10–20 ft. long coming from seed sown in early May. It is very easy of cult. and usually seeds itself. Var. **variegâtus,** Hort., is the most popular form. Gng. 1:241. A.F. 8:489. The foliage is variously streaked and splashed with white. Seeds of this variety will give a large percentage of variegated forms, and the plants usually show interesting variations. *H. japonicus* is more popular as an ornamental vine than *H. Lupulus,* because it grows so quickly from seeds, and also because it has such interesting variegated forms; but *H. Lupulus* has a distinct charm in its great hanging hops, and the heavy odor is enjoyed by some persons. L. H. B.

HUNNEMÁNNIA (John Hunneman, English friend of botany, died 1839). *Papaveràceæ.* MEXICAN TULIP POPPY. One yellow-flowered herb closely allied to the California poppy (Eschscholtzia) and of similar garden value, where hardy.

The genus agrees with Eschscholtzia in having much-cut foliage and spreading lobes of the stigma, but differs in having separate sepals instead of the peculiar hood-like calyx of Eschscholtzia which covers the young fl. like a candle extinguisher: torus scarcely dilated; sepals



LVI. Roman hyacinth.—Hyacinthus orientalis variety.

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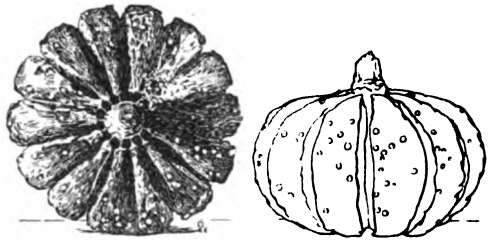
2, caducous; petals 4, spreading, yellow; stamens many, orange-colored; ovary oblong, attenuated into a short style: caps. 1-celled and 2-valved, prominently 10-nerved; seeds many.—Mex. in the xerophytic regions.

fumariæfòlia, Sweet. Perennial, persisting for several years when planted in Calif., but mostly treated as an annual: lvs. triternately divided: peduncles solitary, terminal; fls. 2–3 in. across; sepals ovate, concave, glabrous, longitudinally striate; petals concave, wavy, broadly obovate or nearly orbicular. B.M. 3061. R.H. 1902:112. Gn. 77, p. 288. Gn.W. 15:443. A.F. 27:579.—Sold as giant yellow tulip poppy. Seed sown early in May in the East give bloom in July, and



1923. Hura crepitans. (× about ½)

plants are covered with large yellow fls. until hard frost. The plants have bushy habit and beautiful, feathery, glaucous foliage; 2 ft. The fls. at times stand up like tulips; excellent for cutting. L. H. B.†

HÙNTLEYA (personal name). *Orchidàceæ.* Epiphytal orchids without pseudobulbs, like Zygopetalum.

Leaves several: fls. solitary on long peduncles in the lf.-axils; sepals and petals similar, spreading, the lateral sepals forming a slight chin; lip articulated to the foot of the column, the upper part ovate, concave, narrowed into a broad claw below with a fringed callus; column broadly winged at apex; pollinia 4, upon an ovate stalk.—Species 2, in Trop. Amer.

meleàgris, Lindl. (*Batemánnia meleàgris,* Reichb. *Zygopétalum meleàgris,* Benth.). Lvs. up to 1 ft. long, exceeding the peduncles: fls. about 3 in. across; sepals and petals ovate-lanceolate, acuminate, the base white, the middle portion yellow, the upper part red-brown, yellow-spotted; lip white with a red-brown apex. Brazil. B.R. 25:14. H.U. 1, p. 6.

Bùrtii, Pfitz. (*Batemánnia Bùrtii,* Reichb. *Zygopétalum Bùrtii,* Benth.). Lvs. up to 15 in. long, much exceeding the peduncles: fls. 3–4 in. across; sepals and petals ovate, acute, the base white, followed by a yellow zone, the apex red-brown, yellow-spotted; lip white below, red-brown at apex, the teeth on the disk purple. Costa Rica. B.M. 6003. F.M. 1874:101.

GEORGE V. NASH.

HÙRA (South American name). *Euphorbiàceæ.* Trees, cultivated in the tropics and sometimes in greenhouses as curious or ornamental plants.

Leaves simple, alternate, broad, petioled, hairy: fls. monœcious, apetalous; staminate calyx cupulate, truncate or denticulate; stamens generally numerous, in 2–3 whorls; style long, with flat, radiate stigma; ovules 1 to each of the 5–20 cells: fr. large, flat.—Two species of Trop. Amer.

The sandbox tree, *H. crepitans,* is noted for its explosive capsules which, when ripe, throw the seed many feet with a loud noise. The large poplar-like leaves on long petioles give it quite an ornamental aspect, and it is often planted in the tropics of both hemispheres. It may be grown in Florida and California. The abundant milky juice is poisonous. The tree is suited to light loam soil and is propagated by cuttings in sand with heat, under glass.

crépitans, Linn. SANDBOX TREE. MONKEY DINNER-BELL. Fig. 1923. A tree up to 100 ft. high: lvs. broad-ovate, cordate, acuminate, distantly repand-dentate: fls. small, reddish: caps. 3 in. wide, 1½ in. thick, deeply many-ribbed. Trop. Amer. Lyon Horticole, 1907:125.

J. B. S. NORTON.

HUSK TOMATO: *Physalis.*

HUTCHÍNSIA (named for Miss Hutchins, of Ireland, who was skilled in cryptogamic botany). Syn. *Hymenólobus. Cruciferæ.* Low, annual or perennial herbs with entire or pinnate lvs.: fls. white, small, subcorymbose; pedicels elongated: fr. long-oval or lance-shaped; seeds many or only 2.—Eight species in the Medit. region and the colder parts of the Old World, one species being very widely spread. According to some authorities, Hutchinsia is limited to one species. **H. alpìna,** Ait., is a good subject for the alpine garden and is also occasionally used as a border plant. It grows from 1–4 in. high: lvs. pinnate, shining: fls. snow-white, in clusters, blooming from May to June and often through the summer. Cult. in moist half-shady places and prop. by seeds or cuttings. Gn. 72, pp. 31, 278.

HYACINTH: *Hyacinthus.* Hyacinth Bean: *Dolichos.* Hyacinth, Grape: *Muscari.* Hyacinth, Water: *Eichhornia.*

HYACÍNTHUS (name from Greek mythology). *Liliàceæ.* HYACINTH. Popular hardy spring-flowering bulbs, producing flowers in shades of blue and red, also white; also grown under glass for winter bloom.

Bulbs tunicated: stemless, the lvs. all radical, linear or strap-shaped, the scape simple: fls. in a simple terminal raceme or spike, erect or spreading or pendulous; perianth funnel-shaped to campanulate, nearly or quite equally 6-lobed; stamens 6, attached at the throat or in the tube: caps. nearly globular, 3-grooved or 3-lobed, dehiscent loculicidally; seeds rather few.—Of hyacinths there are something over 30 species, the greater part S. African. Others inhabit the Medit. region, and from this source come the common garden kinds. From related genera, Hyacinthus is distinguished by the funnel-shaped or bell-shaped fl., the throat not constricted, the lobes shorter than or at most not much exceeding the tube, the 6 stamens attached to the tube or throat and the filaments thread-like or dilated at the base. For the general cultural requirements, see *Bulbs.*

orientàlis, Linn. COMMON HYACINTH. Fig. 1926. Lvs. 8–12 in. long, ½–1½ in. wide, thick and green: scape 8–18 in. tall, stout, bearing an elongated and dense raceme: perianth about 1 in. long, the tube usually ventricose or swollen, the lobes oblong-spatulate, as

1924. Cut hyacinth bulb. (×½)

1925. Hollowed hyacinth bulb. (×½)

long as the tube, in many colors, often double in cult. B.M. 937. B.R. 995. F.S. 23:2399–2400.—The hyacinth has been cult. for some centuries, and it shared some of the early popularity of the tulip in the Netherlands. It is wild in Syria, Asia Minor, Greece and Dalmatia. It is extensively grown in Holland for export to this and other countries, and consequently is commonly known as the Dutch hyacinth. The Roman hyacinth

(Figs. 1927, 1928) belongs to the group represented by var. **álbulus**, Baker (*H. álbulus*, Jord.) and var. **prǽcox**, Voss (*H. prǽcox*, Jord.). These are slender plants with narrow erect lvs., fls. fewer and earlier, white to blush to blue, the tube more slender. Var. *præcox* differs from var. *albulus* in its yellow anthers, rather more ventricose tube and stouter growth.

1926. Common or Dutch hyacinth.

amethýstinus, Linn. Slender and graceful, with light blue fls. in short racemes, standing nearly or quite 6 in. high: fls. small, nodding, bell-shaped, with short teeth-like segms. There is a white-fld. form. Spain. B.M. 2425. B.R. 398. Gn. 47, p. 147.—Good for rockeries. Hardy in the middle states.

azùreus, Baker (*Muscàri azùreum*, Fenzl). Looks like a grape hyacinth (or *Muscari*): 4–8 in. tall, with strongly canaliculate, glaucous lvs.: fls. blue, fragrant, in a dense spike 1 in. long, tubular, with small teeth: distinguished from the genus Muscari by the perianth-segms. being flaring instead of incurved. Medit. region. B.M. 6822. G.C. III. 24:191 (var. *giganteus*). Gn. 75, p. 176.—Hardy in middle states. This species is probably to be called *H. ciliàtus*, Cyrill., or a form of it.

lineàtus, Steud. Low, 2–4 in. high: lvs. 2 or 3, oblong-lanceolate, falcate, about equaling the scape: fls. small (⅛in. or less long), 6–12 in a raceme 1 in. long, blue, campanulate, ascending. Asia Minor. Gt. 1887, p. 446. G.C. III. 29:103; 39:210. Gn. 76, p. 169. J.H. III. 65:203 (as *H. azureus* var. *lineatus*).

fastigiàtus, Bertol. (*H. Pouzòlzii*, Gay). A delicate species, with very narrow lvs., scape 3–5 in. high and shorter than the lvs.: fls. few, in a loose cluster, ¼–⅛in. long and light blue (a white form), with oblong-lanceolate segms. longer than the tube. Corsica. B.M. 6663. —Hardy in S. New England. Has the look of *Scilla verna*.

H. cándicans, Baker=Galtonia. Gn. 75, p. 80. G. 2:546.—*H. romànus*, of Linnæus, is not the H. romanus of horticulturists (which is the Roman hyacinth, a form of H. orientalis). Linnæus' species is a blue-white, scilla-like plant (see B.M. 939, as Scilla romana).

L. H. B.

Culture of the hyacinth.—The perfection of the hyacinth flower depends largely on the strength of the roots, and as the plants make all their root-growth in autumn, the bulbs should be planted early,—say from the beginning to the middle of October. Any good garden soil suits, provided it is well drained. The ground should be carefully prepared by spading to a depth of 20 inches, so that the roots may pass straight through it to their full development of 12 or 16 inches. If the soil is naturally stiff, it may be lightened by the addition of sand, and if the beds have been occupied by other plants during the summer, some clean old cow-manure, well worked in, is recommended. Horse-manure should not be used.

The bulbs should be planted 6 inches deep (to the bottom of the bulbs) and very uniformly, to insure simultaneous flowering. The ground having been prepared as above, perhaps the best way is to remove 3 or 4 inches of the earth, level the bed carefully with the rake and set the bulbs in it 5 or 6 inches apart each way, pressing them in firmly, and then covering them evenly with the earth that has been taken out. When winter sets in, the beds should be covered with 2 inches of dry litter or coarse manure. As soon as the shoots appear above ground in the spring, 1 inch of this covering should be removed and the remainder when danger from late frosts is past.

For large beds and borders, second-size named hyacinths are used to a great advantage. The flower-spikes are not so large as from the first-size bulbs, but the latter when in bloom in the open usually become top-heavy and are often blown down by wind, while the flowers of the second-size bulbs stand more erect and last longer.

Forcing in pots.

For growing indoors in pots, large, solid bulbs should be chosen, and potted singly in 5-inch pots in a rich compost of loam, leaf-mold and sharp sand. A few pieces of broken pot being placed in the bottom for drainage, the pots should be filled lightly, and the bulbs pressed into the loose soil till only the apex remains above the surface. The pots are then buried to a depth of 8 or 10 inches in the open ground or in a frame for seven or eight weeks, till the roots are developed fully and the sprout is about 1½ inches above the bulb. When taken inside, they should be kept in subdued light, at a temperature of about 50°, until the sprout has assumed a vigorous green color. Florists who force large numbers for winter decorations set them under the greenhouse benches for about two weeks, and then force them in a temperature of 70°. A greater heat than this attenuates the growth and weakens the color. Syringing with water twice a day is recommended, and as the flower-spike develops, weak manure-water is helpful. The slower hyacinths are forced, the finer and more lasting will be the bloom. Bulbs wanted in flower for Christmas should be potted in September, and for a succession later, at intervals as desired. Single hyacinths are handsomer and force better than the double, although a few of the latter may be recommended. The following are among the best adapted for forcing and are largely grown by American florists:

Single blue.—Grand Maitre, deep lavender-blue. Czar Peter, light blue. King of the Blues, dark blue. Leonidas, clear blue. Queen of the Blues, light blue. Regulus, porcelain-blue. Schotel, pale blue.

Double blue.—Bloksberg, porcelain-blue. Van Speyk, lilac-blue.

Single white.—Angenis Chistina, pure white. Baroness van Thuyll, pure white. Grandeur a Merveille, blush-white. La Grandesse, pure white. L'Innocence, pure white. Madame Van der Hoop, pure white. Mimi, blush-white. Paix dé l'Europe, pure white.

Double white.—La Tour d'Auvergne, pure white. Isabella, blush-white.

Single red.—De Wet, light rose. Gertrude, bright pink. Gigantea, bright rose. Lady Derby, lovely pink. La Victoire, brilliant scarlet-red. Moreno, waxy pink. Norma, delicate waxy pink. Robert Steiger, crimson.

1927. Roman hyacinth.

Double red.—Bouquet Tendre, crimson. Noble par Merite, deep rose.

Single lilac.—Sir William Mansfield, lilac-mauve.

Single yellow.—King of the Yellows, deep yellow. Yellow Hammer.

Double yellow.—Goethe. Bright yellow.

Miniature hyacinths, or "Dutch Romans," are small-sized bulbs of the ordinary Dutch hyacinths. They are excellent for growing in groups in bowls, pans or flats, planted close together and treated the same as the large hyacinths when grown in pots.

Culture in glasses.

Some of the single hyacinths may be grown very satisfactorily in water. Special glasses for the purpose can be bought from the seedsmen. They should be filled with pure water and the bulb so placed that its base barely touches the water. The glasses must then be placed in a dark closet or cellar till sufficiently long roots have developed and the main flower shoot is about 3 inches tall. This usually requires eight to ten weeks. Thereafter they may gradually be brought into the light. An airy, sunny situation and a temperature of about 60° regularly maintained will insure the best results. The glasses should be kept filled by adding water occasionally as required. A small piece of wood charcoal placed in the glass tends to keep the water pure and sweet.

The following varieties are especially suited for glasses: Lady Derby, pink. Lord Macaulay, deep rose. Mina, pure white. L'Innocence, pure white. La Victoire, brilliant red. Grand Maitre, blue. Grand Lilas, light blue. King of the Blues, dark blue. Schotel, finest light blue. Mimi, blush-white. MacMahon, pure yellow. Moreno, deep rose. Lord Balfour, lilac tinged violet.

Roman hyacinths.

Instead of one large truss from each bulb, the Roman hyacinth produces three or four smaller but more graceful flower-spikes. The bulbs arrive in America in August, and by successive pottings they may be had in flower from November till May. They require the same forcing treatment as the larger hyacinths, but three or four bulbs may be planted in a pot. The florists use wooden flats instead of pots, setting the bulbs close together, forty or fifty in a flat. By reason of its beauty and exquisite fragrance, its earliness and easy culture, the white Roman hyacinth is the most popular of winter-blooming plants. Several millions of these bulbs are grown annually by the florists of the large cities for winter cut-flowers.

Within the last few years, large quantities of Dutch hyacinths have been planted and grown for one year in the south of France, where they ripen off several weeks earlier than in Holland. Consequently, these hyacinths can be forced in bloom two to three weeks earlier than the ordinary Holland-grown stock of the Romans.

The propagation of hyacinths.

With the exception of the Roman hyacinths (which come from the south of France), the world's supply of hyacinth bulbs is produced in Holland. The soil and climate of that country seem to be peculiarly suitable for bulb-growing, which has been one of the leading industries there for 200 years. The bulbs intended for next year's market are planted in October in carefully prepared, richly manured land, and protected over winter by a thick covering of reed or litter. The flowers are cut when in full bloom in the spring. By July the bulbs are fully ripened, and are taken out of the ground by hand, dried, cleaned and assorted into three grades of quality, according to size. Early in August they are ready for shipping. Overgrown or unshapely bulbs are reserved for propagating. As soon as these are taken out of the ground, three deep cross cuts are made with a sharp knife in the bottom of each bulb. They are then set out, bottom upward, and covered with loose soil for two or three weeks, during which time the cuts open out and the wounds are healed. They are then taken up and kept spread out on tables in storehouses till October, when they are planted out. When lifted next June, nothing of the parent bulb remains but dry skins, on the edges of which twenty to thirty offsets are fastened. These bulblets are picked off by hand and planted out in autumn, just like large bulbs. This process of planting in autumn and taking up in summer for a two months' rest is repeated for four or five years, till the bulbs have attained to marketable size. Another method of propagating is to hollow out the bottom of the bulb smoothly to a point in the center. More offsets are secured in this way, but they are smaller and take a year or two longer to reach maturity. These methods are illustrated in Figs. 1924, 1925.

1928. Roman hyacinth.

New varieties are obtained from seed, but as the present leading varieties have attained a very high degree of perfection in form and in color, few seedlings show marked improvements on existing sorts. New varieties are also produced by "sporting," that is, one plant spontaneously assumes a new and different character from the remainder of the stock and from this one plant new stocks are grown. In this way the beautiful light rose variety DeWet sported from single blue Grand Maitre, while single purple Lord Balfour first appeared in a stock of the deep rose Moreno, and so on.

The tendency to produce new varieties should be restricted to distinctive forms and colors. Many of so-called new varieties recently introduced are merely slight alterations in form or color of the parent bulb, not sufficient in appearance to justify calling them new sorts, merely increasing the list of named sorts for advertising or selling purposes. J. M. Thorburn & Co.

HYÆNÁNCHE (Greek, referring to its native African use as a hyena poison). *Euphorbiàceæ*. Small tree, sometimes grown in greenhouses. Lvs. whorled or sometimes opposite, simple, entire: fls. dicœcious, apetalous, in axillary clusters; sepals in staminate fls. 5–12, stamens numerous: ovules 2 in each of the 3–4 cells. The single species is **H. capénsis,** Pers. (*Toxicodéndron capénse*, Thunb. *H. globòsa*, Lamb.). HYENA POISON. A much-branched tree, 5–6 ft. high: lvs. linear to oblong, base cuneate, apex rounded, glabrous: caps. subglobose. S. Afr. It is adapted to well-drained light soil, and is prop. by cuttings in sand under glass. During its rest-period water should be given sparingly. J. B. S. NORTON.

HYBÁNTHUS (from Greek meaning *hump-backed flower*). *Violàceæ*. Species about 50, in Old and New World, mostly in tropical and subtropical parts. One species native to the E. U. S., is sometimes listed: it is an herbaceous perennial 1–2 ft. high, with mostly oblong, narrowly acuminate lvs. 3–5 in. long, and small nodding greenish fls. solitary or in pairs in many of the lf.-axils: sepals linear and equal; petals mostly nearly equal in length, connivent nearly their entire length, the lower one much larger, saccate at the base, emarginate at the broad apex; stamens with broad connectives wholly connate into an ovoid sac open only between the free tips, a rounded or 2-lobed scale-like gland adnate to the base anteriorly.

cóncolor, Spreng. (*Ionídium cóncolor*, Benth. & Hook. *Sòlea cóncolor*, Ging. *Cubèlium cóncolor*, Raf.). May, June. Moist woods and ravines, Ont. to Ga. and West. F. W. BARCLAY.

HYBRIDS are the products of crossing between species. Of late, the word hybrid has been used by most writers to comprise all crosses, whether between species or varieties. The justification of this usage is the fact that there are no hard and fast lines between varieties and species, and therefore that hybridism in the old sense is incapable of exact delimitation. The opponents to this usage, however, contend that so long as it is customary to speak of species and varieties as different classificatory categories, it is equally allowable and useful to speak of hybrids as between species and of crossbreeds as between varieties; moreover, historical custom favors this usage. Common-language terms rarely if ever express absolute or ideal truth: they grow up by custom. Whenever new ideas and discoveries render them inexact, it may be quite as well to invent new terms as to give new and technical meanings to old terms which are thoroughly established in literature. The word hybrid has always been a specific term, and it were a pity now to make it a generic one, particularly since there is a well established generic term. The generic word, both substantive and verb, is *cross*. Specific kinds of crosses are hybrids, between species; crossbreeds, between plants of the same species; half-hybrid, between a species and a variety of another species; bigener, between plants of different genera. There are technical terms to designate the various kinds and degrees of crossing. The word hybrid has now become so flexible, however, and other standards of measurement are so much in vogue, that these special terms are little used.

It was formerly held that inability to make fertile hybrids is proof that the forms are distinct species; and contrarywise, that plants which make fertile crosses are of one species. Hybridization has also been made a test of genera. These notions are now given up, for crossing and classification belong to two unlike categories of facts. Species and genera are not entities in themselves, but are mere artificial groups made by men for their convenience when writing and speaking of living things. Crossing is a biological phenomenon.

Hybrids are unusual facts in nature; that is, they are rare compared with the whole number of plants. On the other hand, cross-breeds are usual. Most flowers are so constructed as to favor cross-pollination. Cross-breeding is one of the prime means of inducing slight variations and of invigorating a type. Upon the variations which arise from crossing and other means, natural selection operates in the production of new forms. But it is significant that these new forms usually come about slowly and gradually. It is the desire of the cultivator to produce new forms quickly and of pronounced distinctness. He therefore employs crossing between unlike types, or species, hoping thereby to secure wider departures. In nature, the cross-breed is the beginning of a process of breeding: it starts off the variation. Man is often tempted to look upon the hybrid as the end. If the products of a given cross are not to his liking, he throws them away and tries again. The most expert plant-breeders, however, now hybridize to get a "break," and thenceforth depend chiefly on selection to realize their clear-cut ideals, particularly in seed-propagated plants.

To man hybrids are of no value unless they can be propagated. By seeds they usually vary immensely: it is difficult to "fix" them so that they will come true. By cuttings or layers or division, however, the character of the parent may be propagated with practical certainty: the original plant is divided, and the parts are put on the market. Nearly all commercial hybrids are of plants which are thus propagated by asexual parts: Kieffer pear, hybrid grapes, Wilson blackberry, Wild Goose plum, cannas, roses, begonias, anthuriums, fuchsias, pelargoniums, rhododendrons. Since the hybrid is variable when propagated by seeds, continued selection, or plant-breeding, must be employed to fix and establish a desirable type.

It is thus seen that hybridization rarely gives rise to dominant horticultural seed-races, but rather to an individual plant which may be disseminated by some divisional means of propagation. The seeds of hybrids —as of the modern cannas—may give rise to good varieties, and they may not; but these new varieties are, in their turn, usually propagated by means of asexual parts if they are to be kept true.

Practically there is no certainty in hybridization. Rarely can a man picture to himself an ideal variety, and then by means of hybridization produce it. He hybridizes plants which possess some of the characteristics of the desired or ideal variety, and then takes his chances. True plant-breeding sets an ideal, and then reaches it by working along certain definite lines. It seeks first to secure a variation in the desired direction: this may be secured by means of crossing, change of soil, modification of food-supply, and other changed conditions. It seeks, then, to preserve or augment the form by means of definite selection.

We are not yet able to formulate positive laws of hybridization. Every hybrid is a law unto itself. By the study of many examples of hybridization, one is able to construct an average of probabilities as to what will or what will not occur in a given case: but the given case may contradict all the probabilities without apparent cause. Hybridization is an empirical subject.

One cannot tell what species will or will not hybridize except by trying. Hundreds of species have been tried, and for them the knowledge is more or less exact. Plants hybridize most freely which are the subjects of much care and coddling: the orchids are the best examples. In these groups, hybrids are chiefly fanciers' plants, valuable often only because they are hybrids or are rare and curious. One cannot tell beforehand whether the products of any hybridization will be exact intermediates, or in what way or degree they will carry over or blend the parental characters. As a rule, the more closely akin the species, the more perfect will be the blending or amalgamation of the two. See *Breeding of Plants*, Vol. I.

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The literature of hybridization is extensive but scattered. The possibilities of hybridization as a factor in plant-breeding are presented in many aspects in the "Hybrid Conference Report" of the Royal Horticultural Society, London, 1900. There are special books devoted to orchid hybrids (see *Orchids*). See an excellent paper by Swingle and Webber, "Yearbook of the United States Department of Agriculture," 1897; papers in "American Gardening," 1899, pp. 397, 413, 431; Bailey & Gilbert's "Plant-Breeding;" De Uries' "Plant-Breeding." L. H. B.

HYDRÁNGEA (Greek, *hydor*, water, and *aggeion*, vessel; alluding to the cup-shaped fruit). *Saxifragàceæ*. Ornamental woody plants, grown chiefly for their showy white, pink or blue flowers.

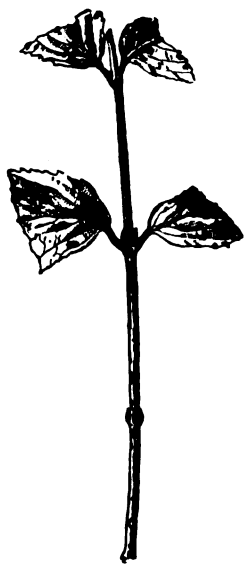
Deciduous shrubs: lvs. opposite, without stipules, petioled, serrate, sometimes entire, rarely lobed: fls. perfect, in terminal panicles or corymbs, often with sterile marginal fls.; calyx-lobes and petals 4–5; stamens usually 10; ovary inferior or half-inferior; styles 2–5, short: caps. 2–5-celled, dehiscent at the base of the styles, with many minute seeds.—About 35 species in N. and S. Amer., Himalayas and Cent. and E. Asia, of which more than 20 occur in China; for a key to the Chinese species, see Rehder, Synopsis of the Chinese Hydrangeas (in Sargent, Plantæ Wilsonianæ 1:34–41).

The hydrangeas are highly ornamental mostly low shrubs, rarely vines climbing by rootlets, with medium-sized or rather large leaves and small white, bluish or pinkish flowers in corymbs or panicles, bearing usually marginal sterile flowers, with enlarged showy sepals, or in some varieties all the flowers are sterile and enlarged. *H. paniculata* is the hardiest of all, but *H. arborescens*, *H. radiata*, *H. xanthoneura* and *H. Bretschneideri* are also almost hardy North, while *H. quercifolia* and *H. petiolaris* are hardy as far north as Massachusetts, and *H. involucrata*, *H. opuloides*, *H. Sargentiana*, *H. heteromalla* and *H. Davidii*, are still more tender, and cannot be grown outdoors North.

They grow best in a rich, porous and somewhat moist soil and thrive well in partly shaded positions, but flower more freely in full sun if they only have sufficient moisture. All hydrangeas are well adapted for borders of shrubberies, and *H. paniculata* and *H. opuloides*, especially the varieties with sterile flowers, are very showy as single specimens on the lawn. In warmer climates the latter is sometimes used for ornamental hedges (see G.C. III. 24:337, 456); but it is not hardy in the North. These and also most of the other species should be pruned in fall or early spring, and the branches of the previous year cut back to one to three pairs of buds, according to the growth of the branches and the desired size of the panicles; if only slightly pruned, the panicles will be many but small. Sometimes they are cut back every year almost to the ground and produce then enormous panicles, which, however, usually need artificial support and lack the gracefulness of less severely pruned plants. *H. paniculata* var. *grandiflora* can be grown into a small standard tree; for this purpose vigorous young plants should be selected and planted in rich soil, and cut down to the base. The strongest shoot of each plant will attain by fall the height of 4 to 6 feet, if freely manured and watered during the summer; in autumn, all the weaker branches are cut off, and in colder climates the plants should be lifted and stored in a frost-proof pit or cellar, since the wood is usually not sufficiently ripened to withstand severe frost. In the following year the top of the stem is allowed to branch. The weaker basal shoots may be pegged down to make new plants. Strong-growing varieties of *H. opuloides* may be treated in the same way if standard plants are desired.

The method of winter protection of hardy hydrangeas adopted around Newport, Rhode Island (and possibly other places) may be worthy of mention. In the case of individual specimens, after the leaves have dropped in the fall, the branches are tied together and the plant covered with a box having open ends. The box is then filled with earth. When the plants are growing together in a bed or border, they may be treated in a similar way by placing boards along the side of the bed, to assist in retaining the earth that is used as a covering material. If, after the branches are tied, they are bent over somewhat, a saving of labor is effected by reason of a smaller quantity of earth being sufficient to cover them. (Montague Free.)

H. opuloides, which cannot withstand much more than 10° of frost, is in the North much grown as a pot-plant, especially the more showy varieties with large heads of sterile flowers, and is extensively used for outdoor decoration during the summer. Late in fall, when the leaves have fallen after frost, the plants are moved to a frost-proof cellar and kept rather dry until spring, when they are repotted in new soil and the growth of last year cut back to one or two pairs of buds. As a suitable soil may be recommended a mixture of loam, leaf-mold and sand, with ground bone, dried cow-manure or some other kind of manure added. During the summer a liberal supply of water should be given, also occasionally applications of liquid manure, until the flowers have developed. They may also be planted in the open ground during the summer, lifted late in fall with a large ball of earth, stored over winter in a coldframe or pit and planted out again in spring; this will not injure in any way the profusion of flowers. In certain kinds of soil the pink hortensias show a tendency to turn blue, and perhaps this can be caused by adding iron filings or alum to the soil. *H. opuloides* is also a valuable plant for forcing, and is much grown for Easter, especially the var. *otaksa*, on account of its dwarfer habit. Handsome pot-plants can be grown in one year from cuttings. In February or March cuttings are inserted in the propagating-house with slight bottom heat, and planted in small pots as soon as they are rooted. During the summer they may be easily grown in pots and plunged outdoors in coal-ashes or in any kind of porous soil, transplanted several times, and freely watered and occasionally manured; or they may be planted out in rich soil, exposed to the full sun, where water should be liberally given and now and then an application of liquid manure. Last of September they should be repotted in 8-inch pots, kept shady some days until established, and afterward exposed to the sun. After the first frosts they may be brought into a cool greenhouse. If intended to have them in flower for Easter, they should be transferred not later than the fore part of January into a warmer house, with a temperature gradually rising from 50° to 60°; the plants should be freely watered, and about once a week an application of liquid manure given until the flower-buds are developed. The flowers should be almost fully developed some time before they are desired, that they may be hardened off in a cooler house, since overforced plants are likely to collapse if exposed to sudden changes of temperature. After



1929. Summer cutting of Hydrangea paniculata.

flowering, the plants are pruned and repotted or planted out and treated as above described for cuttings, or they may be thrown away and another set of plants raised from cuttings.

H. petiolaris is a handsome climbing plant for covering walls and trunks of trees, and grows well in the shade, but flowers freely only in the full sun.

The hydrangeas are readily propagated by cuttings of half-ripened or nearly ripe wood under glass in summer (Fig. 1929); also by hardwood cuttings, layers, suckers or division of older plants. *H. quercifolia* is best propagated by suckers or by layers of growing wood put down in summer. Rarely increased by seeds, which are very small, and should be sown in fall in pans or boxes and only slightly covered with soil.

INDEX.

acuminata, 7 (1).
albo-variegata, 7.
altissima, 16.
anomala, 16.
arborescens, 8.
aspera, 13.
Azisai, 7 (1).
Belzonii, 7 (1).
Bretschneideri, 4, 5.
Buergeri, 7 (1).
cinerea, 9.
cordata, 8.
cyanea, 7 (1).
cyanoclada 7 (2).
Davidii, 6.
fimbriata, 7 (3).
floribunda, 2.
glabrescens, 4.
grandiflora, 2, 8.
heteromalla, 3.
Hortensia, 7 (2).
hortensis, 2, 7, 14.
involucrata, 14.
japonica, 7 (1).
Lindleyana, 7 (1).
macrophylla, 13.
macrosepala, 7 (1).
mandshurica, 7 (2).
Mariesi, 7 (1).
monstrosa, 7 (2).
nigra, 7 (2).
nivalis, 7.
nivea, 10.
opuloides, 7.
otaksa, 7 (2).
paniculata, 2.
pekinensis, 4.
petiolaris, 15.
plena, 7 (2).
præcox, 2.
prolifera, 7 (3).
pubescens, 3.
quercifolia, 1.
radiata, 10.
ramulis, 7 (2).
rosalba, 7 (1).
rosea, 7 (2).
roseo-marginata, 7.
Rosthornii, 12.
rubro-plena, 7 (3).
Sargentiana, 11.
scandens, 15.
serrata, 4, 7 (1).
setchuenensis, 5.
stellata, 7 (3).
sterilis, 8, 9.
strigosa, 13.
tardiva, 2.
Thunbergii, 7 (1).
tricolor, 7.
urticifolia, 8.
variegata, 7.
Veitchii, 7 (1).
vestita, 3, 4.
volubilis, 15.
Wilsonii, 5.
xanthoneura, 5.

A. *Shrubs erect or spreading: stamens 10: petals expanding.*

B. *Infl. pyramidal.*

1. **quercifòlia,** Bartram. Shrub, with spreading branches, to 6 ft.: young branches densely ferrugineously tomentose: lvs. long-petioled, roundish or broadly ovate, pinnately lobed with serrate lobes, glabrous above at length, whitish tomentose beneath, 4–8 in. long: panicle 4–7 in. long; fls. pinkish white, the sterile ones turning purple; styles 2: caps. with the calyx-teeth at the apex. June. Ky. to Ala. and Fla. B.M. 975. Gng. 2:305. Gn.M. 2:66. G.C. II. 22:369. Gn. 27, p. 199. G. 27:389. G.W. 5, p. 109. M.D.G. 1913:517.

2. **paniculàta,** Sieb. Shrub or small tree, to 30 ft., with dense globose head: lvs. elliptic or ovate, acuminate, serrate, sparingly pubescent above, more densely on the veins beneath, 2–5 in.: panicle 6–12 in. long; fls. whitish, the sterile ones changing later to purplish; styles 3: caps. with the margin of the calyx about at the middle. Aug., Sept. Japan, China. S.Z. 61. F.E. 15:501; 34:387. F.R. 21:9. G.W. 2, p. 114; 12, p. 366. G.C. III. 9:553. Gn. 59, p. 181; 75, p. 548; 76, p. 5. Mn. 9:75. The following varieties are cult.: Var. **floribúnda,** Regel. Panicles large, with more and larger sterile fls. Gt. 16:530. Var. **grandiflòra,** Sieb. (var. *hortènsis*, Maxim.). Fig. 1930. Almost all fls. sterile; panicles very large and showy. F.S. 16:1665, 1666. Gn. 10:37; 38, p. 569; 54, p. 376; 64, p. 407; 72, p. 560. R.H. 1873:50; 1899, pp. 130, 131. Mn. 8:119. A.G. 18:313. Gng. 3:357; 5:3. F.E. 8:214. S.H. 1:174. G.M. 39:728; 46:794. Gn.M. 2:67. A.F. 17:194, 517. C.L.A. 7:43. G.W. 8, p. 210; 15, p. 454. G.Z. 10:80. Var. **præcox,** Rehd. Fig. 1931. Almost like the type, but flowering about 6 weeks earlier, in the middle of July; sepals usually elliptic. G.F. 10:363 (adapted in Fig. 1931). The late-flowering typical form is sometimes called var. **tardìva,** Hort.—*H. paniculata* var. *grandiflora* is the common hydrangea of lawns. It is seen to best effect when planted close in front of heavy shrubbery. Cut back rather heavily in early spring.

BB. *Infl. corymbose, flat or globular.*

C. *Ovary partly superior, hence caps. ovoid, with the margin of the calyx about the middle; styles usually 3: sterile fls. present.*

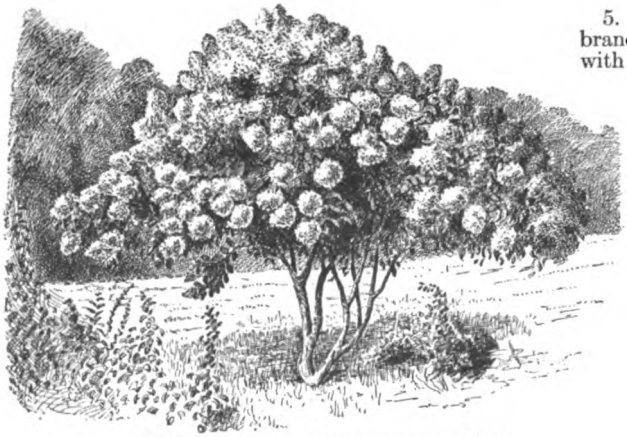
D. *Fertile fls. white.*

E. *Lvs. white-tomentose below.*

3. **heteromálla,** Don (*H. vestìta*, Wall. *H. pubéscens*, Decne.). Shrub, to 10 ft.: petiole deeply grooved and margined, red; lvs. ovate, acuminate, densely setosely dentate, almost glabrous above, densely whitish-tomentose beneath, 4–8 in. long: cyme 5–8 in. broad, with bracts; sepals of sterile fls. elliptic or obovate, acute or mucronulate: caps. with the calyx above the middle. June, July. Himalayas. F.S. 4:378—79. G.C. II. 22:617. G.M. 50:859.

EE. *Lvs. villous or nearly glabrous below.*

4. **Brétschneideri,** Dipp. (*H. vestìta* var. *pubéscens*, Maxim. *H. pekinénsis*, Hort.). Fig. 1932. Shrub, to 8 ft.: last year's branchlets with chestnut-brown bark peeling off in thin flakes: petioles not margined; lvs. ovate or elliptic-ovate to oblong-ovate, acute or acuminate, serrate with short callous teeth, more or less pubescent beneath, 3–5 in. long: cymes similar to the former but smaller and denser; sepals roundish, obtuse: caps. with the calyx near the middle. July. N. China. G.F. 3:17 (adapted in Fig. 1932); 6:396. G. 27:387. Gng. 16:305. G.W. 9, p. 541. Var. **glabréscens,** Rehd. (*H. serràta*, Koehne, not DC.). Lvs. smaller, elliptic, more coarsely serrate and only sparingly pubescent.



1930. Hydrangea paniculata var. grandiflora.

5. **xanthoneùra,** Diels. Shrub, to 15 ft.: last year's branchlets with close chestnut-brown bark marked with conspicuous lenticels: lvs. elliptic to elliptic-oblong, abruptly acuminate, serrate, glabrous and bright green above, marked with more or less conspicuous yellow veins, light green below and glabrous or slightly pubescent on the veins, 4–7 in. long; petioles ½–1¼ in. long: corymbs rather loose, convex, 5–10 in. across; sterile fls. 1¼–2 in. across, with oval obtuse sepals. July. W. China. Var. **Wílsonii,** Rehd. Last year's branchlets grayish or pale brown: lvs. somewhat narrower, glossy above. W. China. M.D.G. 1912:26. The handsomest form of the species. Var. **setchuenénsis,** Rehd. (*H. Brétschneideri* var. *setchuenénsis*, Rehd.). Last year's branchlets light brown: lvs. to 8 in. long and to 4 in. broad, villous below. W. China.—This species and its varieties have proved hardy at the Arnold Arboretum. It is very similar to the preceding species, but easily distinguished by the close bark.

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DD. *Fertile fls. bluish or pink: lvs. glabrous or pubescent only on the veins below.*

6. **Dàvidii,** Franch. Shrub, to 6 ft.: young branchlets finely appressed pubescent, older light brown: lvs. elliptic-lanceolate or ovate-lanceolate, long-acuminate, cuneate at the base, sinuately serrate, yellowish green and nearly glabrous above, pubescent on the veins below, 3½–6 in. long: corymbs loose, convex, sometimes nearly paniculate, 6–8 in. across; sepals and petals lanceolate; sterile fls. about 1½ in. across, with 3 or 4 sepals: caps. with the margin of the calyx about or slightly below the middle. W. China.—Handsome species with its large loose corymbs of blue fls.; tender.

7. **opuloìdes,** Koch (*H. hortènsis,* Smith. *H. Hortènsia,* DC. *H. japónica,* Sieb.). Shrub, to 8 ft., almost glabrous: lvs. ovate or ovate-elliptic, acuminate or acute, coarsely serrate, 5–8 in. long: fls. in large cymes without bracts, white, bluish or pink, few or all of them sterile.—The greenhouse hydrangea. June, July, but blooming in winter under glass. A large number of varieties have been intro. from Japan and China, where this species has been extensively cult. for many centuries, and where it is native. The following are some of the best known. They may be divided into 3 groups:

(*1*) *Japonica group: cymes flat, with sterile and fertile fls.*

Var. **acuminàta,** Dipp. (*H. acuminàta,* Sieb. & Zucc. *H. Buérgeri,* Sieb. & Zucc.). Lvs. ovate-lanceolate, acuminate, sparingly appressed-pubescent: sterile fls. with elliptic entire sepals, usually blue. S.Z. 56, 57. Var. **Azísai,** Dipp. (*H. Azísai,* Sieb.). Lvs. elliptic-ovate, glabrous: sterile fls. with obovate sepals, long-pedicelled, overtopping the fertile ones. S.Z. 51. Var **Belzònii,** Schneid. (*H. Belzònii,* Sieb. & Zucc. *H. japónica* var. *cærùlea,* Hook. *H. japónica* var. *cærulèscens,* Regel). Of dwarfer and stouter habit: lvs. ovate or obovate, short-acuminate, glabrous, somewhat thick: sterile fls. whitish, pinkish, or bluish, with rhombic, usually entire sepals. S.Z. 55. B.M. 4253. Here belongs also var. *Imperatrice Eugenie* with pink fls. R.H. 1868:471. Var. **japónica,** Schneid. (*H. japónica,* Sieb.). Lvs. ovate to elliptic, acuminate, glabrous: sepals broadly ovate, toothed, pink. S.Z. 53. B.R. 30:61. R.H. 1874:90 (as *H. acuminata*). Var. **macrosépala,** Dipp. Differs from the former only by its larger sepals. Gt. 15:520. Var. **Màriesi,** Hort., seems also not much different, but has somewhat broader lvs., and the pink sterile fls. are very large. Gn. 54: 390. G.C. III. 23, suppl. May 28. G. 26:409. G.M. 41:347; 46:577, 578. G.W. 6, p. 557; 9, pp. 413, 414. Var. **Veìtchii,** Hort. Similar to the preceding variety, but sterile fls. pure white, 3–3½ in. across. G. 26:175. Var. **Lindleyàna,** Rehd. (*H. rosálba,* Van Houtte. *H. hortènsis* var. *Lindleyàna,* Nichols.). Lvs. ovate or elliptic-ovate, acuminate, sparingly hairy: sepals dentate, ovate or broadly ovate, white and pink, or white changing to pink. F.S. 16:1649, 1650. R.H. 1866:430. Gn. 46:466. Var. **serràta,** Rehd. (*H. serràta,* DC. *H. Thúnbergii,* Sieb. & Zucc. *H. cyánea,* Hort.). Lvs. elliptic or ovate, narrowed at both ends, serrate, sparingly appressed-hairy, 1½–3 in. long: cymes small, 3–4 in. broad; fls. pinkish or bluish; sepals roundish, obtuse or emarginate. S.Z. 58. G.C. 1870:1699.

(*2*) *Hortensia group: cymes globose, with almost all fls. sterile.*

Var. **cyanóclada,** Dipp. (*H. mandshúrica,* Koehne. *H. Hortènsia* var. *nìgra,* Arb. Kew. *H. nìgra,* Carr. *H. rámulis coccíneis* and *H. rámulis pictis,* Hort.). Branches dark purple or violet, often almost black: lvs. ovate-elliptic, acute: cymes large, with purple peduncles; sepals pink or bluish, obovate. A.F. 5:361. Var. **Hortènsia,** Dipp. Lvs. large, elliptic, glabrous: sepals broadly ovate, entire, usually pink. This is the form which first came into cult. outside of Japan and China, and is said to have been intro. from China to England in 1790, by Joseph Banks. B.M. 438. G.C. III. 24:45; 52:251. Gn. 45, p. 12; 50, pp. 123, 256, 367; 52, p. 281. F.E. 18:277. A.G. 1900:695. Gn.M. 2:66.

1931. Hydrangea paniculata var. præcox. (×⅓)

G. 4:223; 15:139; 20:441. Var. **plèna,** Regel. Similar to the preceding, but sepals toothed. Var. **otáksa,** Dipp. (*H. otáksa,* Sieb. & Zucc.). Fig. 1933. Dwarfer, but of vigorous growth: lvs. obovate, short-acuminate, rather thick, glabrous: sepals obovate, entire, pink or blue. S.Z. 52. F.S. 17:1732, 1733. Gn. 50: 122. R.H. 1868:450. Mn. 5, p. 105. A.G. 11:415; 19: suppl. Feb. 12; 44:415. A.F. 10:1015. F.E. 9:52, 401. Gng. 5:161; 6:7. Here belong also the following 4 forms: Var. *otáksa monstròsa,* Lambert, with very large heads. S.H. 2:517. G.W. 13, p. 43. Var. *otáksa monstròsa nàna,* Brunnemann. A very dwarf form of the preceding. M.D.G. 1909:235. Var. *ròsea,* Veitch. Lvs. smaller, more finely serrate: fls. deep rose-color or bright blue. Gt. 53:1533 (rose). R.H. 1904:544 (blue). Gn. 50:122. G.W. 7:582. Gn.W. 22:493. Var. *Thomas Hogg,* Hort. Lvs. elliptic, or ovate: heads pure white, large. One of the best as a pot-plant. It is also to be recommended for outdoor cult., as it is one of the hardiest.—Some beautiful forms mostly of hybrid origin of the Hortensia group have recently appeared in the trade, of these may be mentioned here: *Madame E. Mouillère,* white fls. with crenate close sepals. R.H. 1912, p. 62. M.D.G. 1911:41. G.C. III. 49:204. Gn. 75, p. 180. *Beauté Vendomoise,* fls. very large, with clawed and crenate sepals, fls. therefore open in the center. R.H. 1912, p. 63. *Professor D. Bois,* fls. deep rose, large, sometimes 5 in. across. R.H. 1912, p. 325. *Eclaireur,* fls. large, rose-carmine, said to be the most deeply colored form. *Mademoiselle Renée Gaillard,* fls. white with dentate sepals. M.D.G. 1911: 38, 39. *Avalanche,* fls. pure white. *Genérale Vicomtesse de Vibraye,* with very large pink fls., with entire sepals. R.B. 37:377. *Président Viger,* very floriferous, clusters large, fls. very large, with dentate sepals, bright pink. *Saarbrücken,* dwarf, with very large heads of pink fls.; sepals denticulate. M.D.G. 1910:601. G.W. 15, p. 76. For other varieties see: M.D.G. 1911:38–41, 265–273; 1912:210, 211.

(3) Stellata group: fls. with many narrow sepals.

Var. **stellàta,** Dipp. (*H. stellàta,* Sieb. & Zucc.). Lvs. ovate or ovate-oblong, sparingly pubescent: cymes with larger sterile and smaller fertile fls., both with many narrow-elliptic sepals. S.Z. 59. Var. **fimbriàta,** Dipp. Cymes rather dense, with almost all the fls. sterile; sepals fimbriate, white, pink toward the base. G.C. III. 23, suppl. May 28. Var. **prolífera,** Hort. (*H. stellàta* var. *prolífera,* Regel). The fertile fls. bearing 1 or few smaller ones in the center. Var. **rùbro-plèna,** Dipp. Cymes rather dense, with almost all fls. sterile, changing from pink or pale lilac to dark red.

There are also some varieties with variegated lvs., as var. **variegàta,** Hort. (*H. japónica variegàta,* Hort.), a form of var. *japonica* with the lvs. edged white (H.F. 1861:108); var. **álbo-variegàta,** Hort. (*H. japónica fol. álbo-variegàtis,* Hort.), a form of var. *Belzonii,* with the lvs. edged white (F.S. 7:696. G. 27:517); var. **trícolor,** Hort., with the lvs. variegated with white and edged yellow; var. **ròseo-marginàta,** Hort., with the lvs. spotted white and edged pink; var. **nivàlis,** Hort. (*H. Hortènsia nivàlis,* Bull & Sons). Lvs. with a deep green margin and an irregular patch of creamy white in the center. G.C. III. 32:455. G.M. 47:639.

1932. Hydrangea Bretschneideri. (×⅓)

cc. *Ovary inferior, hence caps. truncate, with the calyx-teeth at the apex; styles usually 2.*

d. *Cymes without involucre at the base.*

e. *Branchlets and lvs. glabrous or lvs. villous or tomentose below: seeds not winged.*

f. *Lvs. glabrous below.*

8. **arboréscens,** Linn. (*H. urticifòlia,* Hort.). Erect shrub, 4–10 ft.: lvs. long-petioled, ovate, acute or acuminate, rounded or cordate at the base, serrate, green and glabrous on both sides or somewhat pubescent or glaucous beneath, 3–6 in. long: cymes 2–5 in. broad, with none or few sterile fls. June, July. N. J. to Iowa, south to Fla. and Mo. B.M. 437. G.W. 15, p. 612. Var. **cordàta,** Torr. & Gray, has the lvs. broadly ovate and cordate. Var. **stérilis,** Torr. & Gray. A form with all the fls. sterile; sepals broadly oval, rounded or mucronate at the apex: lvs. oval to oblong-ovate, rounded or abruptly contracted at the base. It is doubtful whether this form is still in cult. Var. **grandiflòra,** Rehd. A form of var. *cordata* with all the fls. sterile: heads 5–7 in. across; fls. ¾–1 in. across with ovate acute sepals: lvs. ovate to ovate-elliptic, cordate or rounded at the base. M.D.G. 1907:380; 1909:4; 1912:472. Gn. 75, p. 435. G.W. 13, p. 617. R.B. 33:375; 34:259. G. 31:671. F.E. 22:70; 28:359; 31:606. G.M. 50:357.—A striking plant with its showy large heads of white fls.; quite hardy.

ff. *Lvs. tomentose or densely grayish pubescent below.*

9. **cinèrea,** Small. Shrub, to 6 ft.: lvs. membranous, oval or broadly ovate to ovate-oblong, rounded or cordate at the base, serrate, densely grayish pubescent below, 2½–6 in. long: corymbs 2–5 in. across, usually with sterile fls. June, July. B.B. 2:185 (as *H. radiata*); (ed. 2) 2:231. N. C. to Tenn. and Ala. Var. **stérilis,** Rehd. All fls. sterile, in dense heads 5–7 in. across; fls. about ½in. across with oval obtuse sepals. F.E. 28:359; 30:911.

10. **radiàta,** Walt. (*H. nívea,* Michx.). Similar to the former, but lvs. leathery, densely whitish tomentose and reticulate beneath and cymes always with sterile fls. June, July. N. C. and S. C. F.E. 32:11.

ee. *Branchlets strigose or bristly and lvs. strigose or densely clothed with rough hairs: seed winged.*

f. *Base of lvs. rounded or subcordate.*

11. **Sargentiàna,** Rehd. Shrub, to 6 ft. with stout upright branches clothed with harsh hairs and stiff bristles: young growth more or less purple: lvs. ovate to ovate-oblong, shortly acuminate, crenate-serrate, dull green and hairy above, densely rough-villous below, 6–12 in. long; petioles 1½–3½ in. long: cymes nearly flat, dense, 5–6½ in. across; fertile fls. pale violet, the sterile fls. white; style 2–3. July, Aug. Cent. China. B.M. 8447. Gn. 77, p. 264. G.M. 55: suppl. p. 5, June 1.—A strikingly handsome plant with its large lvs., the dense pubescence purplish on the young growth and with its large cymes bluish violet in the center and surrounded by conspicuous white sterile fls. It is rather tender and can be grown outdoors in the S. only and demands a shady position.

12. **Rósthornii,** Diels. Shrub, to 12 ft.: branchlets strigose: lvs. roundish-ovate or ovate, occasionally ovate-oblong, acuminate, cordate at the base, unequally or doubly fimbriate-dentate, sparingly strigose above, densely grayish strigose and reticulate below, 4–9 in. long and 3–7 in. broad; petiole 1½–4 in. long: cymes 4–7 in. across; sterile fls. 1–1½ in. across, white or purplish; sepals suborbicular or oval, entire or serrate; styles 2. July. W. China.

ff. *Base of lvs. cuneate.*

13. **strigòsa,** Rehd. (*H. áspera,* Hemsl., not Don). Shrub, to 8 ft.: branchlets strigose: lvs. oblong-ovate to elliptic-lanceolate or lanceolate, acuminate, serrulate or serrate, sparingly strigose or nearly glabrous above, densely strigose below, 3–7 in. long; petiole about 1 in. long: cymes 4–6 in. across; sterile fls. white or sometimes purple, 1–1½ in. across, with broadly oval, entire or serrate sepals; styles 2. Aug. Cent. China. Var. **macrophýlla,** Rehd. (*H. áspera* var. *macrophýlla,* Hemsl.). Lvs. 8–12 in. long: cymes to 8 in. across with the sterile fls. about 2 in. broad.

dd. *Cyme inclosed before expanding by 6–8 large, deciduous bracts.*

14. **involucràta,** Sieb. Low shrub, to 5 ft.: lvs. oblong, acuminate, densely and sharply serrate, appressed-pubescent on both sides, rough to the touch,

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4–8 in. long: bracts at the base of the cyme large, orbicular; smaller bracts none: fertile fls. blue or pinkish, sterile ones whitish: caps. with the calyx at the apex; styles usually 2. Aug. Japan. S.Z. 63. J.H. III. 32:103. *H. Sapphire*, intro. 1890, seems to belong here. Var. **hortènsis**, Maxim. Fls. double, usually pink and often proliferous. S.Z. 64. F.S. 3:187.

AA. *Shrubs climbing by aërial rootlets: petals cap-like, cohering, falling off as a whole.*

15. **petiolàris**, Sieb. & Zucc. (*H. scándens*, Maxim., not DC. *H. volùbilis*, Hort.). Climbing to 80 ft. in Japan: lvs. long-petioled, broadly ovate-cordate to elliptic, acute or acuminate, serrate, almost glabrous, 2–4 in. long: cymes rather loose, 8–10 in. across, with rather few sterile fls.; stamens 15; styles usually 2: caps. with the calyx at the apex. July. Japan, Saghalin. B.M. 6788. S.Z. 54, 59, 2, 92. M.D.G. 1897:236, 237. S.H. 2:191, 193. Gn. 62, p. 248; 64, p. 219. G. 35:461. —A very variable species, figured and described by Sieb. & Zucc. under 3 different names. In gardens it is often met with under the name of *Schizophragma hydrangeoides*, another Japanese climber of similar habit, which, however, is easily distinguished by its sinuately dentate lvs. and its sterile fls. having only 1 large cordate sepal.

16. **anómala**, Don (*H. altissima*, Wall.). High climbing, glabrous: lvs. ovate to elliptic-ovate or ovate-oblong, broadly cuneate at the base, denticulate-serrate, 2–4 in. long; petioles ¾–2 in. long: cymes loose, puberulous, 4–6 in. across; stamens 10; sterile fls. few or sometimes wanting, about 1 in. across, with suborbicular sepals. July. W. China, Himalayas. Wallich, Tent. Flor. Nepal. 50.

H. áspera, Don. Shrub, to 20 ft., similar to H. strigosa: lvs. oblong-lanceolate, fimbriate-denticulate, densely villous beneath: sepals usually toothed: styles usually 3. Himalayas. Tender.—*H. canéscens*, Koch (H. arborescens × H. radiata). Very similar to H. cinerea, but the hairs smooth or nearly smooth under the microscope, in H. cinerea tuberculate. Garden origin.—*H. hírta*, Sieb. & Zucc. Shrub, to 4 ft.: lvs. broad-elliptic, coarsely incised-serrate: cymes without sterile fls. Japan. S. Z. 62. Not very decorative.—*H. lóngipes*, Franch. Allied to H. Rosthornii. Lvs. thinner, smaller, more coarsely serrate, sparingly strigose or glabrescent below; petioles 2–7 in. long. Cent. and W. China.—*H. robùsta*, Hook. f. & Thoms. (H. cyanema, Nutt.). Closely related to H. Rosthornii. Spreading shrub, to 15 ft., with large ovate lvs., pubescent on both sides: sterile fls. with toothed sepals. Himalayas. B. M. 5038. Handsome in bloom, but tender.—*H. róseo-paniculàta*, Foucard. Supposed to be a hybrid of H. paniculata and H. opuloides. Fls. rose-carmine. R. H. 1912, p. 324.—*H. villòsa*, Rehd. Allied to H. strigosa. Branchlets, petioles and cymes clothed with spreading villous hairs: lvs. strigose above, with a rough woolly tomentum below, 4–7 in. long. W. China. Var. *strigòsior*, Rehd. Branchlets and petioles with shorter and fewer or without spreading hairs: lvs. smaller.—*H. vírens*, Sieb. Slender shrub, to 6 ft.: lvs. elliptic or lanceolate, coarsely serrate, 1–2½ in.: cymes rather few-fld., sterile fls. with 3 or 4 large, unequal sepals, white. Japan. S. Z. 60. A desirable shrub, with graceful and delicate fls. and with the lvs. often handsomely variegated along the veins, but tender.

ALFRED REHDER.

HYDRÁSTIS (name of doubtful meaning). *Ranunculàceæ*. Hardy herbaceous perennials, grown in a few gardens for their showy leaves and beautiful red fruit. The roots are ground when dry and used for medicine.

Stem erect, pubescent: lvs. palmately 5–7-lobed, serrate: fls. greenish white, small, solitary; sepals 3, petal-like, falling early; petals none; stamens many: carpels 2-ovuled, in fr. becoming aggregated berries. —Two species, 1 from Japan and 1 from N. Amer., the former (*H. jezoensis*, Sieb.) apparently not in cult.

Moist situations in good, rich loam with plenty of leaf-mold are required. Seeds may be sown in moist, shaded soil of a sandy nature. This is done in fall or early spring. The seeds should be covered very slightly but a mulch or covering is helpful. Plants which have grown in one place for a number of years are easily propagated by division of the roots in late fall or early spring. The commercial cultivation of goldenseal for medicinal purposes is explained in Farmers' Bulletin No. 613 (United States Department of Agriculture) by Walter Van Fleet.

canadénsis, Linn. ORANGE ROOT. GOLDENSEAL. St. 4–10 in. long, from a thick, yellow rootstock: basal lvs. 5–8 in. broad; st.-lvs. 2, lower one petioled, upper sessile and near the small fl.: fr. in ovoid raspberry-like head, the 8–12 fleshy carpels tipped with a short, curved beak. April. E. U. S., as far south as Mo. and Ga., in rich woods. B.M. 3019 (in flower); 3232 (in fruit).

K. C. DAVIS.

HYDRIASTÈLE (Greek, *water* and *column;* the tall trunks growing near springs). *Palmàceæ*, tribe *Arèceæ*. A monotypic genus containing a tropical Australian palm advertised sometimes as *Kentia Wendlandiana*. This may belong to Exorrhiza, which see. If it is a true Hydriastele, however, it is told from the kentias in foliage by the leaf-segments split at the apex instead of acuminate and not split.

1933. Hydrangea hortensis var. otaksa.

More fundamentally, Hydriastele differs in having the ovule on the side of the cell instead of at the bottom, as in Kentia. In this respect it agrees with the group of genera mentioned under Hedyscepe, but it differs from that group in having the fls. borne in 4 ranks instead of spirally. Hydriastele is a spineless palm with erect winged caudex: lvs. terminal, pinnatisect; segms. alternate, linear, split at the apex; midveins covered below with caducous scales; margins thin; rachis laterally compressed, dorsally convex; face of the petiole concave; sheath rather short: spadices with short, wide peduncles, branched from the base, the branches obtusely quadrate, long, slender, pendulous: spathes 2, complete, compressed, deciduous, the lower one ancipital: bracts and bractlets connate: fr. small, ellipsoidal, smooth or ribbed.

This distinct and excellent palm has hitherto been rare, but now that the seeds are being produced in tropical nurseries it is fast becoming popular. The seeds are round, fairly hard, and resemble those of *Archontophœnix Alexandræ*. The characteristic leaves are pinnatifid, the segments being irregular and somewhat jagged at the apex, after the fashion of a fish-tail palm or caryota. It stands the temperature of an ordinary living-room better than many other palms. For rapid growth it needs more heat than *Howea Belmoreana* and *H. Forsteriana*. In the greenhouse a temperature of 60° to 70° is most congenial. A lower temperature will not hurt it, but gives a slower and more compact growth. It loves plenty of moisture, and frequent syringing is

beneficial. For potting soil, it likes rich loam, with plenty of sharp sand and good drainage. The seeds and seedlings should be treated more like the commercial areca, i.e., *Chrysalidocarpus lutescens*. It forms a single stem when only 3 feet high, and grows to a height of 20 feet or more in cultivation. It is at its best when 10 to 15 feet high. When well established and pot-bound it loves high feeding, as does *Chrysalidocarpus lutescens*. (H. A. Siebrecht.)

1934. Hydrocleis nymphoides. (×⅓)

Wendlandiàna, H. Wendl. & Drude (*Kéntia Wendlandiàna*, F. Muell.). A tall palm in nature with the lvs. many feet long; segms. numerous, unequal, the longest 1½ ft., the upper ones confluent at the base, all denticulate at the apex. Queensland.

N. TAYLOR.†

HYDRÍLLA (*water* plant with *whorled* lvs.). *Hydrocharitàceæ*. One aquatic plant of Cent. Eu., Asia and Austral., offered abroad as a water or aquarium subject. **H. verticillàta,** Casp. Forming large masses, leafy, submerged, dicœcious: lvs. linear or oblong, serrulate or entire, 4–8 in a whorl, very short (¼–⅓in. long): sterile or male fls. solitary and short-pedicelled in a sessile spathe; sepals, petals and stamens 3: fertile or female fls. 1–2 and sessile in the spathe; sepals and petals 3; ovary extending beyond the spathe into a beak; stigmas 3: fls. very small; the male fls. detach and float.

L. H. B.

HYDRÓCHARIS (Greek, *graceful water plant*). *Hydrocharitàceæ*. FROGBIT. A monotypic genus, an aquatic plant, grown in a few aquaria. It is found in ditches and ponds in Eu. and Temp. Asia. **H. Mórsus-rànæ,** Linn., has floating sts. resembling runners, and tufts of radical lvs. and submerged roots: lvs. stalked, roundish, with a heart-shaped base, rather thick, about 2 in. across: peduncles of the staminate plant bearing 2–3 fls. on long pedicels, which spring from a spathe of 2 thin bracts; petals 3, white, stamens 3–12; spathe of the pistillate fls. sessile among the lvs.; styles 6, with 2-cleft stigmas. For American frogbit, see *Limnobium*. Hydrocharis dies in the fall, but winter-buds (see similar buds of Elodea, Fig. 1391) break off and sink when the old plants die. In spring, or in the greenhouse or aquarium under genial conditions, they start early into growth, the scales bursting and a young lf. developing and then the whole rises to the surface. It is a very interesting plant. Its fine, silky roots are beautiful and attractive in the aquarium, as well as the soft, tender lvs. and delicate fls.

WM. TRICKER.

HYDRÓCLEIS (*water key*). *Butomàceæ*. Sometimes spelled *Hydrocleys*. Water plants, one of which is very useful for summer ponds and for aquaria.

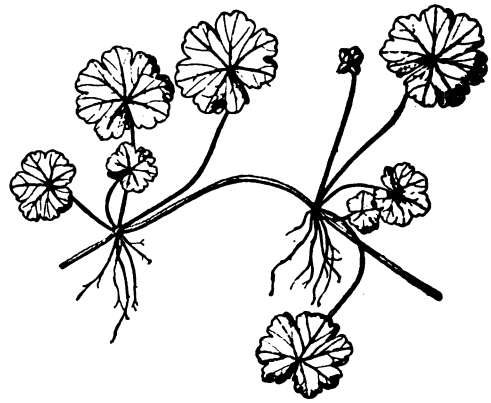
Floating: lvs. broad, ovate to strap-shaped: fls. perfect, mostly large; sepals 3, coriaceous and persistent; petals 3, thin and fugacious; stamens many or numerous, the external sterile: carpels 3, rarely 4 or 6 or even 8, lance-linear, connate at base, gradually attenuate into the style.—The latest monograph (Buchenau, Engler's Pflanzenreich, hft. 16, 1903) recognizes 3 species, from Brazil. The genus is sometimes united with Limnocharis, from which it differs in having definite rather than many carpels, and the papillose introrse stigmas.

nymphoìdes, Buchen. (*H. Cómmersonii*, Rich. *H. Húmboldtii*, Endl. *Limnócharis Húmboldtii*, Rich. *L. Cómmersonii*, Spreng. *L. nymphoìdes*, Mich. *Stratiòtes nymphoìdes*, Willd. *Vespúccia Húmboldtii*, Parl.). WATER-POPPY. Fig. 1934. Perennial: st. prostrate and rooting: lvs. broad-cordate-oval, thick, mostly floating: fls. and lvs. arising from bracted nodes, both long-stalked: fls. 2–2½ in. across, with 3 obovate-rounded light yellow petals: carpels 5–7, not united. Brazil, to Buenos Ayres. B.M. 3248. B.R. 1640.—A handsome plant with the yellow fls. (lasting 1 day) standing well above the water. In habit, remarkably like *Limnanthemum nymphoides*. Grows well in an aquarium or in shallow water. Continuous bloomer; not hardy to frost. The cult. of *Hydrocleis nymphoides* is of the simplest. When grown in tubs, fill them in two-thirds full of moderately rich soil, covering with sand and fill up with water. Two or 3 plants planted in the center in a short time will furnish the tub with its bright glossy green lvs. and numbers of its bright cheery yellow fls., which continue late in the season. In natural ponds, planted on the edge, the plants grow very rapidly, and spread over a large surface of water. In artificial ponds, plant in tubs or boxes and place in shallow water or stand the tub or box on some stand, allowing 6–9 in. depth of water.

WILLIAM TRICKER.
L. H. B.

HYDROCÓTYLE (Greek, *water* and *cup;* the plants thrive in moist places, and the roundish leaves have a cup-like depression in the middle). *Umbelliferæ*. WATER PENNYWORT. Slender creeping perennials of wet places, one of which is somewhat used in carpet-bedding.

Herbs, with round or reniform often peltate lvs., and scale-like stipules at the base of the petioles: fls.



1935. Hydrocotyle rotundifolia. (×⅓)

very small, white, in umbels or umbel-like clusters opposite the lvs., sometimes 1 umbel appearing above another; calyx-teeth minute; petals entire, concave: fr. strongly compressed.—Species about 75, widely distributed around the world, several being native in the U. S. and Canada.

rotundifòlia, Roxbg. (*H. sibthorpioìdes*, Lem. *Sibthórpia europæa*, Hort., not Linn.). Fig. 1935. Lvs.

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LVII. Hylocereus tricostatus in Hawaii. Hedge planted by Sibyl Moseley Bingham, between 1831 and 1840.

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shining, ¼–1 in. across, orbicular, cordate, subentire or 7–9-lobed to the middle or lower, doubly crenate: umbel 6–8-fld.: fr. 2-ribbed. Trop. Asia and Afr.—Numerous synonyms are accounted for by the variable length of the petiole. Prostrate, rooting at the nodes.

vulgàris, Linn., offered abroad: creeping or floating, rooting at the nodes: lvs. orbicular, 1 in. or less across, crenate or slightly lobed, centrally attached, the petioles surpassing the peduncles: fls. minute, white, in 2 or 3 whorls or in a single umbel: marshes and bogs, and edges of ponds. Eu. L. H. B.†

HYDRÒLEA (probably from *water*, because of the habitat). *Hydrophyllàceæ.* Annual or perennial herbs or subshrubs, scarcely cult., of warm countries and a few in the U. S.; species perhaps a dozen: now often included with Nama (which see): branching plants, sometimes spiny: lvs. ovate or lanceolate, entire, pinnate-veined: fls. blue or white, in clusters or solitary; corolla broadly campanulate or nearly rotate, 5-cleft; stamens 5, about the length of the corolla, with filaments dilated below: fr. a globular caps. with minute seeds. Four species occur in the U. S.: *H. corymbòsa,* Ell. (*Nàma corymbòsum,* Kuntze), with clustered blue yellow-nerved fls. ⅜in. across, and oblong to oblanceolate lvs.: S. C. to Fla. *H. quadrivàlvis,* Walt. (*H. caroliniàna,* Michx. *Nama quadrivàlvis,* Kuntze), with solitary or few-clustered blue or lilac fls., and linear-elliptic lvs.: Va., south. *H. ovàta,* Nutt. (*Nama ovàtum,* Brit.), with purplish or white fls. in leafy-bracted panicles, and ovate or elliptic lvs. Swamps, Mo. to La. and Texas. *H. affinis,* Gray (*Nama affine,* Kuntze), with violet fls. in few-fld. leafy clusters, and linear-elliptic lvs. Ind. and Ill. to Miss. and Texas. L. H. B.

HYDROPHÝLLUM (Greek, *water-leaf;* application obscure). *Hydrophyllàceæ.* WATER-LEAF. A half-dozen or more American hardy herbaceous plants, mostly perennial, suitable for wild gardens and for colonizing in shady rich places.

Plants with pinnate or palmately cut foliage and cymose clusters of numerous small white, lilac, light blue, purplish or violet fls. in early summer: floral parts in 5's; calyx appendaged or not; corolla bell-shaped, the tube within bearing a linear longitudinal appendage opposite each lobe, with infolded edges, forming a nectar-bearing groove; stamens and 2 styles usually exserted: caps. 2-valved, with 1–4 nearly globular seeds.—Mostly in moist woods and copses. The perennial species are useful for planting about remote borders of shrubbery, where they take care of themselves.

A. *Calyx appendaged with a reflexed lobe at each sinus: biennial.*

appendiculàtum, Michx. Loosely branching, 1–2 ft., hirsute with long spreading hairs: root-lvs. pinnately 5–7-parted; st.-lvs. palmately 5–7-angulated-lobed: fls. violet or purple, the stamens little exserted. Vt., south and west.

AA. *Calyx not prominently appendaged (often minutely appendaged in H. canadense): perennial.*

B. *Lvs. pinnately cut.*

capitàtum, Douglas. Tufted, about 9 in. high, with fascicled fleshy roots: lvs. softly hirsute or pubescent, ovate or roundish, 5–7-parted, the divisions lobed and cleft: fls. in close clusters, on peduncle shorter than petiole, blue. Colo., west.

occidentàle, Gray. Pubescent, hirsute or sparingly hispid, 1–2 ft.: divisions of the lf. 7–15: fls. violet-purple, varying to white; peduncle longer than the petioles. Calif., Ore.

virginiànum, Linn. Glabrous or nearly so, 1–2½ ft.: lvs. pinnately divided, the 5–7 divisions ovate-lanceolate or oblong: fls. white or violet-purple, the peduncles longer than the petioles. Quebec, west and south.

BB. *Lvs. palmately cut.*

canadénse, Linn. Nearly smooth, 1–2½ ft.: lvs. 5–7-lobed, rounded: fls. mostly greenish white, sometimes purplish the peduncles usually shorter than petioles. B.R. 242. L. H. B.

HYDRÓSME (name probably refers to the wet or aquatic habitat). *Aràceæ.* By some held to be the proper genus for *Amorphophallus Rivieri* (*H. Rivieri,* Engl.); but in the latest monograph (Engler, Pflanzenreich, hft. 48, 1911) it is included in Amorphophallus, as is also Corynophallus, constituting a section of the genus. When kept distinct from Amorphophallus, the separation is largely on technical characters of the seeds.

The section Corynophallus of the genus Amorphophallus, as accepted by Engler, comprises only *Amorphophallus leonensis,* Lem. (*Corynophallus Afzelii,* Hort. *C. leonensis,* Engl. *Hydrosme leonensis,* Engl.), which is sometimes cult. in two or three forms (Vol. I, p. 276): peduncle very stout, 3–8 in. high, from an oblate tuber, bearing a pyriform erect spathe 6 in. high; tube of spathe 1¾ in. diam, white; limb concave, 3½ in. broad at about the middle, rounded at top; mouth of spathe dark purple streaked with dirty white and bearing a few roundish spots; lips of spathe black-purple, incurved: spadix expanding toward the top so that it nearly fills the spathe, brown and mottled: lf. 1, appearing after the fls., on an erect petiole 2–3 ft. high, the blade about 12 in. across and trisect; primary segms. 1- or 2-pinnatifid, the ultimate segms. narrow-linear. Sierra Leone, and adjacent regions. B.M. 7768. F.S. 2:161. G.C. 1872:1619. Var. *spectàbilis,* N.E. Br. (*Corynophàllus Afzèlii* var. *spectàbilis,* Mast.), petiole bearing obscure linear-oblong spots. Var. *élegans,* N. E. Br. (*C. Afzèlii* var. *élegans,* Mast.), petiole green, segms. 2-pinnatisect, the ultimate segms. very narrow. Var. *latifòlia,* N. E. Br. (*C. Afzèlii* var. *latifòlia,* Mast.), petiole green, segms. pinnatisect, the ultimate segms. broader and confluent.—This variable species may be found only rarely in choice collections. L. H. B.

HYDROTÆNIA (Greek, *water* and *band;* referring to a triangular glandular bar which secretes nectar). *Iridàceæ.* Four species of tender bulbs from Mexico and Peru, more curious than beautiful, allied to Tigridia.

From Tigridia (with which the genus is sometimes united), it is distinguished by the perianth-segms. lacking a spreading blade, the perianth being campanulate; tube none; filaments united in a cylindrical column as long as the anthers; ovary clavate, 3-celled: sts. 1–3 ft., simple, or slightly branched above, bearing 1 or more lvs.: cormous.

Van Houttei, Baker. St. 2–3 ft. long, bearing 2–3 fls.: lvs. lanceolate, plaited, the lower 1 ft. long: spathes inflated, 2 in. long: outer segms. oblong, over 1 in. long, greenish outside, inside dark brown, much veined, yellowish at tip, very obtuse: inner segms. suborbicular, half as long, pale lilac, somewhat veined. Mex. F.S. 21:2174 (as *Tigridia Van Houttei*).—Corm said to be eaten in its native region. L. H. B.

HYLOCÈREUS (*wood* and *Cereus*). *Cactàceæ.* A high-climbing cactus, with stems three-angled or -winged, adhering to walls and trees by numerous aërial roots.

Spines small, usually inconspicuous: fls. nocturnal, usually very large, with red or greenish sepals, white or pinkish petals: fr. large, spineless, covered with numerous lf.-like bracts.—Some 16 species of this genus are known, but only 1, and that under a wrong name, is grown to any extent in this country. The species are easily grown in hothouses, especially if given a wall to climb upon. A very curious small-fld. species, *H.*

minutiflorus, has recently been described by Britton & Rose. It flowers freely in Washington and New York, but as yet has not been very widely distributed.

tricostàtus, Brit. & Rose (*Cèreus tricostàtus*, Gosselin. *C. triangulàris* of most writers, not of Haw.). Plate LVII. Vines often 20–40 ft. long, green: ribs 3, thin, crenate, with a corneous margin: spines 2–4 from each areole, short: fls. about 1 ft. long, white: fr. large, red without, white within, edible. Mex. B.M. 1884.

H. extènsus, Brit. & Rose (Cereus extensus, Salm-Dyck). Sts. creeping, perhaps also sometimes climbing, bearing aërial roots, green, rather slender, 3-sided, with obtuse angles: fls. large and handsome; sepals tipped and margined with red; petals rose-colored; style thick, longer than the stamens. This species was described by De Candolle in 1828, but it is unknown in cult. and in a wild state. A species under this name was figured in B. M. for 1844, but this may or may not be the plant described by De Candolle.—*H. napoleònis*, Brit. & Rose (Cereus napoleonis, Graham). Sts. much branched, with 3 acute angles; spines 4–5, rigid, 4–5 lines long: fls. 8 in. long; sepals yellow; petals pure white. This species is not in cult. and is not known in the wild state. It was described and figured from a plant which flowered in Edinburgh about 1836. It is occasionally reported in cult.; but all such material seems to be wrongly identified.

J. N. Rose.

HYMENÆA (Greek, *nuptial;* in allusion to the paired lfts.). *Leguminòsæ*. Ten species of evergreen unarmed trees in Trop. Amer.: lvs. alternate, with 1 pair of coriaceous lfts.: fls. in short corymbose panicles; sepals 4; petals 5, generally oblong, scarcely longer than sepals; stamens 10, distinct; ovary short-stalked with few seeds: pod oblong to obovate, thick, often nearly cylindric, woody, indehiscent. The following species is the most important of the genus and occasionally cult. in tropical collections and in greenhouses of botanic gardens for its economic interest. Prop. is by cuttings in summer under glass with bottom heat or by seeds. It yields a fragrant amber-like resin known as courbaril, or American or West Indian copal; the heavy, close-grained and hard wood is used for wheelwork, tree-nails, beams and in various machinery; the sweetish acid pulp of the pods is eaten by the Indians.

Courbaril, Linn. Tree, to 60 ft.: lfts. 2, nearly sessile, oblong, very oblique at the base, acuminate, glabrous, about 3 in. long; petiole ½in. long: fls. short-pedicellate; petals about ¾in. long, yellow, striped purplish: pod few-seeded, 3–4 in. long. W. Indies to Brazil.

Alfred Rehder.

HYMENÁNTHERA (from the Greek for *membrane* and *anther*, in allusion to the anthers being terminated by a membrane). Syn. *Solenántha*. *Violàceæ*. Stiff shrubs or small trees: lvs. alternate or sometimes fascicled, entire or toothed, with small fugacious stipules: fls. small, axillary or on the naked branches below the lvs., regular, hermaphrodite or unisexual: fr. a small subglobose berry; seeds 2, rarely 3–4.—About half a dozen species from New Zeal., Austral., Tasmania and Norfolk Isls. *H. crassifòlia*, Hook. f., is offered abroad. A low, rigid, much-branched shrub 2–4 ft. high: bark white, furrowed: lvs. very thick and coriaceous, linear-spathulate, entire, sinuate or toothed: fls. small, solitary or few together, axillary: berry white or purplish, ⅛–¼in. diam. New Zeal. Gn. 75, p. 568.—A variable species. Should be grown in a warm, sunny place as a rock-garden plant. Prop. by seeds, cuttings or layers in summer. Good for amateurs on account of the early fls., March to April, and particularly the ornamental berries, which retain their characters a long time. In cold climates needs winter protecton; hardy in south of England.

L. H. B.

HYMENOCÁLLIS (*beautiful membrane*, alluding to the webbed filaments). Including *Ismène*. *Amaryllidàceæ*. Spider-Lily. Sea-Daffodil. Bulbous plants of the warm parts of the New World (one in Africa), cultivated for the fragrant white (in one species yellow) umbellate flowers.

Perianth salverform, with a cylindrical tube, equal linear or lanceolate segms.; stamens 6, the filaments free above but webbed and united into a cup below, the anthers narrow and versatile; ovary 3-loculed, with 2 collateral ovules in each, bearing a long slender style and very small capitate stigma: scape solid and compressed, arising from a tunicated bulb: lvs. oblong or strap-shape.—Species about 40, from N. C. and Mo. to S. Amer., 1 from W. Afr. The genus is represented in the Old World by Pancratium, which differs chiefly in having many superposed ovules in each locule.

Some of the species of Hymenocallis are winter bloomers: these should be treated essentially like crinums, being rested or kept slow in the summer. They require a warm temperature. Of such are *H. macrostephana*, *H. speciosa*, *H. caribæa*. Other species require an intermediate or conservatory temperature, and bloom in spring or summer, resting in winter. Of such are *H. calathina*, *H. Harrisiana*, *H. Macleana*, *H. rotata*, *H. littoralis*. Some of these latter or intermediate-house species are hardy in the southern states, there blooming in spring, as *H. lacera*, *H. galvestonensis*, and others. The species of hymenocallis require no special treatment (see *Bulb*), except that the same bulbs may be flowered year after year if they receive good care. Use turfy or peaty soil that will not become "sour" or soggy. Propagation is by offsets from the bulbs. See *Amaryllis*, for the general handling of this class of bulbs.

INDEX.

angustifolia, 3.	Harrisiana, 6.	rotata, 9.
calathina, 12.	*lacera*, 9.	senegambica, 5.
caribæa, 7.	littoralis, 4.	speciosa, 3.
declinatum, 7.	Macleana, 11.	tubiflora, 1.
galvestonensis, 8.	macrostephana, 10.	undulata, 2.

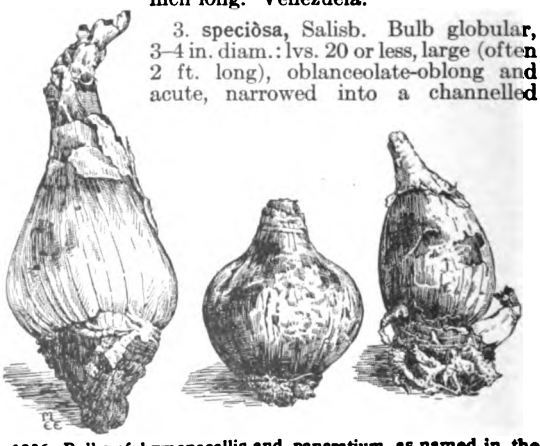
A. *Filaments long and slender beyond the small cup.*

B. *Lvs. distinctly petioled.*

1. **tubiflòra,** Salisb. Bulb ovoid, about 4 in. diam., short-necked: lf.-blade about a foot long and one-third to one-half as broad at the middle, the petiole 6–12 in. long: scape 1 ft. tall; fls. many in the umbel and sessile, the valves or bracts broad and cuspidate; tube of perianth greenish, 6–8 in. long, the linear white reflexing segms. 4 in. long; cup 1 in. long, not toothed, less than half or a third the length of the free part of the filament. N. E. S. Amer. B.R. 265 (as *Pancratium guianense*, Ker).

2. **undulàta,** Herb. Fig. 1936. Bulb ovoid, 3–4 in. diam.: lvs. with an oblong blade 1 ft. long and half as wide, cross-veined: scape 2 ft. long, compressed; fls. about 10, sessile, the tube 6–7 in. long, and the segms. 3–4 in. long and linear, white, with tinged red cup an inch long. Venezuela.

3. speciòsa, Salisb. Bulb globular, 3–4 in. diam.: lvs. 20 or less, large (often 2 ft. long), oblanceolate-oblong and acute, narrowed into a channelled



1936. Bulbs of hymenocallis and pancratium, as named in the trade.—Left, Pancratium maritimum; center, Hymenocallis calathina; right, H. undulata.

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petiole: scape mostly shorter than the foliage, glaucous; fls. 10–15, on very short pedicels, the bracts or spathe-valves 3–4 in. long; tube of perianth greenish, 3–4 in. long, the segms. often twice longer (entire fl. often 9 in. long); cup about 1½ in. long, toothed, the free parts of the filaments little longer than the cup. W. Indies. B.M. 1453. Gn. 47, p. 294. F. 1883, p. 71.—One of the best. The bulb improves with age if care is taken in growing and repotting. The lvs. are evergreen and handsome. Fls. very fragrant, and retaining their scent even when dried. Blooms in winter. This and *H. macrostephana* are the most showy species. Var. **angustifòlia,** Worsley, is a very stiff narrow-lvd. form of recent date.

BB. *Lvs. not petioled, strap-shaped.*

C. *Perianth-tube mostly above 3 in. long.*

4. **littorâlis,** Salisb. Bulb 3–4 in. diam.: lvs. about 12, 2–3 ft. long, 1½ in. broad, acute: scape 2-edged, 2 ft. or less tall; fls. 4–8 in a sessile umbel, the tube 6–7 in. long and green-tinged, the segms. linear and recurved, 4 in. long, joined to the base of the cup; the cup funnel-shape, broader and longer, toothed, the free part of the filaments about 2–3 in. long; style about equaling the stamens. Trop. Amer., widely distributed. Gn. 53, p. 57.—Long known in cult., but less showy than other species.

5. **senegâmbica,** Kunth & Bouché. Lvs. somewhat curved, acute, 2 ft. long, 2 in. broad at the widest place: scape about as long as the lvs.; fls. 6–8 in a sessile umbel, the tube 5–6 in. long, segms. very narrow and 4 in. long; cup funnel-shaped, 1 in. long and somewhat broader, the free parts of the filaments 2 in. long. W. Afr.

6. **Harrisiàna,** Herb. Bulb globular, small (less than 2 in. diam.): lvs. only 3–6, a foot long and 2 in. broad, much narrowed below: scape less than 1 ft. tall, slender, glaucous; fls. 2–3 in a sessile umbel, the tube slender and 3–4 in. long, the segms. linear and 3 in. or less long; cup funnel-shaped, ¾in. long, plicate, small-toothed, the free filaments 1½ in. long and often exceeding the style. Mex. B.M. 6562.—Flowers in early summer. Hardy S.

CC. *Perianth-tube mostly under 3 in. long.*

7. **caribæa,** Herb. (*Pancràtium caribæum,* Linn. *P. declinàtum,* Jacq.). Bulb globular, 3–4 in. diam.: lvs. thin, 12 or more, not 2-ranked, shining, 2–3 ft. long, 2–3 in. broad at the widest place: scape sharp-angled, nearly or quite as long as the lvs.; umbel sessile, 6–12-fld.; tube 2–3 in. long, the segms. linear and somewhat exceeding it; cup 1 in. long, toothed, the free part of the filaments 1½–2 in. long. W. Indies. B.M. 826. L. B.C. 6:558.

8. **galvestonénsis,** Baker. Scape 1–2 ft. long, rather shorter than the linear lvs.: umbel sessile, 4–6; perianth-tube 2–3 in. long (sometimes shorter), mostly a little shorter than the linear segms.; cup 1¼ in. or less long, funnel-shape, the edge erect, the free part of the filaments little more than ½in. long. Texas.—Intro. to cult. with the statement that it "may be planted out in gardens all over the N. like a peony and prove hardy." Spring or early summer.

9. **rotàta,** Herb. (*H. lâcera,* Salisb. *Pancràtium rotàtum,* Ker). Bulb ovoid, 2 in. or less diam., with a long neck and producing stolons or runners: lvs. 6–8, linear, 1½ ft. or less long, flat above but concave toward the base: scape 2-edged, glaucous, about as long as the lvs.; umbel sessile, with 2–6 fls.; tube green, 3–4 in. long, exceeded by the linear, often recurved lobes; cup saucer-shaped or rotate, irregularly toothed, the free part of the filaments 1½ in. long. N. C. to Fla. in low places and in sandy soil. B.M. 827. L.B.C. 1:19.—Variable, particularly in the dimensions of the fl. Spring or early summer.

10. **macrostéphana,** Baker. Fig. 1937. Closely allied to *H. speciosa* and conjectured by Baker to be a hybrid of that species and *H. calathina.* Bulb with a long neck: lvs. 8–9, oblanceolate and bright green, 2–3 ft. long: fls. 6–10, large and striking because of the great cup (whence the specific name), which is 2 in. across and as much long, wavy-toothed; tube greenish, 3 in. long; segms. linear-lanceolate, a little longer than the tube. B.M. 6436.—Blooms in Feb. and March. One of the best of the spider-lilies, perhaps the best for warmhouse cult.

AA. *Filaments short and incurved (usually less than 1 in. long) beyond the large cup. (Ismene.)*

11. **Macleàna,** Nichols. (*Ismène Macleàna,* Herb.). Bulb ovoid, 2 in. diam: lvs. a foot or more long and

1937. Hymenocallis macrostephana. (×⅙)

nearly 2 in. broad, narrowing toward the base: scape 2-edged, about the length of the lvs.; fls. 2–8, with a straight tube 2 in. or less long, and linear, erect or somewhat spreading segms. as long as the tube; cup corolla-like, 1½ in. long and green-striped, fringed, the free filaments ½in. long, strongly inflexed and angled or kneed at the cup. Peru. B.M. 3675.—One of the plants known to the Peruvians as Amancæs, the subject of festivals. This and the next are intermediate house species, flowering in spring and summer.

12. **calathìna,** Nichols. (*Ismène calathìna,* Herb. *Pancràtium calathìnum,* Ker). Fig. 1936. BASKET-FLOWER. Bulb long-necked: lvs. 6–8, somewhat 2-ranked, star-shaped, 2 ft. or less long: scape 2-edged, 1½ to 2 ft. tall, bearing 2–5 fls. in a sessile umbel; tube green, 3–4 in. long, much enlarging above; segms. as long as the tube, ½in. wide, lanceolate; cup corolla-like and green-striped, usually larger than in the last, with rounded fringed lobes; filaments, free for ½in., incurved but not angled. Peru, Bolivia. B.M. 2685.—One of the paler kinds.

The following names may be expected in the trade: *H. adnàta,* Herb.=H. littoralis.—*H. Amàncæs,* Nichols., is one of the Ismene group, and the only species with yellow fls. B.M. 1224. B.R. 600. Gn. 48, p. 168.—*H. amœna,* Herb.=H. ovata (below).—*H. Andreàna,* Nichols. An Ismene: fl. only 1, the cup nearly or quite as long as the segms. R.H. 1884, pp. 129, 468.—*H. crassifòlia,* Herb. =H. occidentalis.—*H. Ernstii,* Worsley. Garden hybrid, H. Mortisiana being one of the parents.—*H. frâgrans,* Salisb.=H. ovata (below).—*H. Moritziàna,* Kunth. Evergreen, with lvs. like eucharis: fls. white, fragrant, with greenish tubes, very slender and twice as long as the segms., the cup very short and toothed. Venezuela. G.C. III. 27: 89.—*H. occidentàlis,* Kunth. Bulbs large: lvs. evergreen, thick, strap-shaped: fls. white, 3–6, the tube 3–4 in. long; cup much narrowed below. S. C. to Mo. and south.—*H. ovàta,* Roem. Lvs. broad and petioled: fls. 6–10, the tube about 2 in. long, the linear segms. little longer; cup 1 in. long. W. Indies. B.R. 43. B.M. 1467.—*H. schizostéphana,* Worsley. Cup laciniate: fls. white, 12–20 in an erect, crowded umbel, the filaments very short and winged at base. Probably Brazil. L. H. B.

HYMENÒDIUM: *Elaphoglossum.*

HYMENOPHÝLLUM (Greek, *membrane-leaf*). *Hymenophyllàceæ*. Like all members of the family, the species are small and with lvs. of very delicate texture; the sporangia are borne in marginal sori protected by 2-lipped cup-like indusium; otherwise the species are like those of Trichomanes, the other large genus of the family.—A genus of about 240 species, nearly all of which are tropical. Culture p. 1214.

A. *Lvs. glabrous; rachis slightly winged above.*

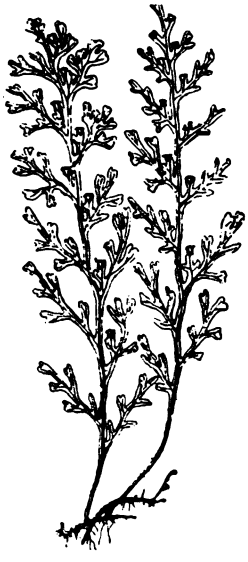
polyánthos, Swartz. Lvs. 2–8 in. long, 1–3 in. wide, tripinnatifid; sori 2–12 to a pinna: involucre small. Tropics of both hemispheres.

demíssum, Swartz. Lvs. 4–12 in. long, 3–4 in. wide, 3–4-pinnatifid; sori very numerous, 20–30 to a pinna: involucre with ovate entire valves. E. Indies to New Zeal.

AA. *Lvs. pubescent or ciliate.*

ciliàtum, Swartz. Fig. 1938. Lf.-stalks ciliated and winged above; lf.-blades 2–6 in. long, 1–2 in. wide, tripinnatifid, the segms. ciliated: involucre roundish, the valves divided half way down and ciliated. Tropics of both hemispheres.

æruginòsum, Carm. Fig. 1939. Lf.-stalks tomentose; lf.-blades 2–3 in. long, 1 in. or less wide, tripinnatifid, the pinnæ often imbricate, the surface and margins densely pubescent: involucres small with valves divided nearly to the base, densely ciliate. Tristan d'Acunha.



1938 Hymenophyllum ciliatum. (×½)

1939. Hymenophyllum æruginosum. (Nat. size)

H. dicranótrichum, Sadeb. (H. chiloense, Hook.). A S. American species with triangular lvs. 2–4 in. long, 1 in. broad, bipinnatifid with rounded segms.; the margins and under surfaces hairy. Gn. 74, p. 228.—*H. fucoides*, Swartz. A common Trop. American species with oblong lvs., 6–10 in. long, 1½–2 in. broad, tripinnatifid, the rachis and mid-veins of the pinnæ winged, the ultimate segms. linear, spinulose. Gn. 74, p. 228.

L. M. UNDERWOOD.
R. C. BENEDICT.†

HYMENÓSPORUM (Greek, *membrane* and *seed;* referring to the winged seeds). *Pittosporàceæ*. An ornamental evergreen shrub or tree from Australia, cultivated in California for its handsome foliage and profusely produced fragrant yellow flowers. On account of its symmetrical pyramidal habit and its fast growth, it is well adapted for street planting.

Leaves large, alternate, entire, crowded toward the end of the branches: infl. a terminal loose panicle; sepals free; petals 5, with obovate blades and the long straight claws approximated into a tube; stamens 5; ovary incompletely 2-celled, cylindric, silky, with a short style: fr. a stipitate, compressed caps. with many compressed winged seeds. This monotypic genus is closely related to Pittosporum which differs chiefly in its thick, not winged seeds surrounded by a sticky substance wanting in Hymenosporum. Propagation is like that of Pittosporum by seeds or cuttings of half-ripened wood.

flàvum, F. Muell. (*Pittósporum flàvum*, Hook. f.). Shrub or tree, to 50 ft.: lvs. obovate, entire, to 9 in. long: fls. yellow, marked with red at the throat, fragrant, over 1 in. across: caps. compressed, 1 in. long and nearly as broad. B.M. 4799. R.H. 1913, p. 327.

ALFRED REHDER.

HYMENÓXYS CALIFÓRNICA: *Actinolepis coronaria.*

HYOPHÓRBE (Greek, *food for swine*, referring to the fruits). *Palmàceæ*, tribe *Chamædòreæ*. Showy ornamental palms from Mauritius, often in trade collections, and well worthy wider cultivation.

Trunks unarmed, stout, either cylindric or in some species with a swelling beneath the lf.-cluster: lvs. terminal, equal, pinnatisect, the lfts. almost always opposite, and usually linear-lanceolate; margins recurved toward the base of the lft. and thickened throughout; petiole somewhat 3-angled and channelled: spadix short-stalked, many-branched, the branchlets spreading: fls. dicœcious or in the different spadices sometimes monœcious, spirally arranged, pale yellow or greenish; sepals and petals 3, the latter small and broadly ovate; stamens 6: fr. somewhat inverted pear-shaped or olive-shaped.—There are only 3 or 4 species, and the genus is most closely related to Chamædorea, of horticultural palms, from which it differs in its usually dicœcious fls. and in having the spadix below the lf.-cluster. I.H. 13:462, 463.

The two species in cultivation are ornamental palms, rather slow-growing and requiring much heat and moisture, and a night temperature of 65°. *H. Verschaffeltii* is much the better of the two species described below from a horticultural standpoint. Propagation is by seeds, which should be sown in a light compost or in pure peat with a bottom heat of 80°. The young seedlings are delicate and need protection from chills and over-watering.

amaricaûlis, Mart. (*Arèca speciòsa*, Hort.?). St. 60 ft. in nature, scarcely so tall in cult., with a bottle-shaped swelling near the base, usually abruptly narrowed near the lf.-cluster: petiole about a foot long, grooved and angled; lfts. 40–60 pairs, about 12–16 in. long and 2 in. broad: spadix about 12 in. long: seed elliptic, about ½in. long. Mauritius.

Verschafféltii, Wendl. (*Arèca Verschafféltii*, Hort.). Trunk 25–30 ft., about 6 in. diam., bulging about half way up: petiole about 3 in. long, slightly grooved on the upper surface and with a yellow band extending from the upper part of the lf.-sheath to the extremity of the blade, which is one of the chief horticultural attractions of the species; lfts. 30–50 pairs, about 2 ft. long and an inch wide: spadix as in the preceding, but the fls. orange: seed nearly cylindric, about ⅞in. long. Mauritius. G.W. 12, p. 207.

H. Commersoniàna, Mart. and *H. índica*, Gaertn. are both Chrysalidocarpus lutescens.

N. TAYLOR.†

HYOSCŸAMUS (Greek, *hog bean*). *Solandceæ*. HENBANE. A coarse, clammy, ill-smelling, wayside weed cultivated for medicinal purposes. An extract is commonly sold in drugstores.

Annual, biennial or perennial, mostly clammy pubescent: lvs. alternate, coarsely toothed, or pinnatifid, rarely entire: corolla pallid or lurid and netted-veined, funnel-shaped, with 5 unequal lobes; stamens mostly

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exserted, declined: caps. 2-celled, circumscissile above the middle. Henbane grows wild in Eu., W. Asia and Himalayas and is naturalized in Amer. It is found in sandy and waste places. The genus contains about 15 species, of the Old World.

niger, Linn. Annual or biennial, 1–2½ ft. high: lvs. 3–7 in. long, the upper ones st.-clasping, irregularly lobed or pinnatifid: fls. greenish yellow, with purple veins, short-pedicelled or sessile, in leafy 1-sided spikes: caps. inclosed in the enlarging calyx.—The plant is said to be poisonous to domestic fowls but not to swine, although it is supposed the generic name has reference to harmful qualities to the latter animals. The lvs. and flowering tops are medicinal. The plant has no horticultural value. June–Sept. L. H. B.

HYOSÈRIS (*swine salad;* i.e., disagreeable or offensive). *Compósitæ.* Four species of nearly stemless herbs of S. Eu. and the Medit. region, one of which is sometimes grown as an alpine: allied to Krigia. Plant glabrous or glandular-pubescent: lvs. radical, pinnatifid: scape 1-headed, leafless, the heads yellow and homogamous; involucre cylindrical-campanulate, the inner bracts 1-rowed and equal, the outer ones few and short; receptacle plane and naked; corollas ligulate: achene glabrous. **H. fœtida,** Linn. (*Aposèris fœtida,* Less.), the species to be expected in the lists is by some authors retained in the genus Aposeris, distinguished by characters of the achene: perennial, much like Taraxacum, glabrous or somewhat pilose on veins on under side of foliage: lvs. runcinate-pinnatifid, the lobes about 10–12 pairs and somewhat triangular and sinuate-dentate: small plants in mountains of Eu. L. H. B.

HYÓSPATHE (*hog spathe:* i.e., hog palm, a vernacular name). *Palmàceæ.* Three S. American palms, little grown, with pinnatisect lvs. and unarmed reed-like sts.: fls. green, minute, the pistillate smaller than the staminate; stamens 6, and staminodia 6 in pistillate fls.: fr. small, ellipsoid or obovoid, purple. *H. élegans,* Mart., of the Amazon, one of the thatch palms, has sts. 1 in. diam. and 6 ft. high: lvs. 3–4 ft. long, at first nearly entire but becoming irregularly pinnate: fls. of both sexes borne in spikes beneath the terminal lvs. Other species sometimes referred to this genus belong to Prestoea and Pigafetta. L. H. B.

HYPÉCOUM (an old Greek name). *Papaveràceæ.* Annual herbs, sometimes grown in the flower-garden. Scapes erect, ascending or prostrate: lvs. radical and more or less rosulate, pinnately parted, the segms. pinnatifid or pinnately lobed, the floral lvs. less divided: fls. rather small, yellow or white; sepals 2, small, deciduous; petals 4, in 2 series, the outer ones often lobed, the 2 inner ones deeply 3-parted; stamens 4, opposite the petals: caps. narrow and silique-like, constricted between the seeds.—Species 15, according to the latest monograph (Fedde, in Engler's Pflanzenreich, hft. 40, 1909), in the Medit. region and east to China. They are of simple cult. under usual garden conditions. *H. procúmbens,* Linn. One foot: sts. or scapes ascending or becoming decumbent in fr.: lvs. glaucous-green, the basal ones 2-pinnatifid and the lobes very narrow and entire: fls. bright yellow, about ½in. across; outer petals somewhat 3-lobed but the side lobes very short. Medit. region to India. Variable. *H. grandiflòrum,* Benth. Six to 12 in., forking: lvs. with narrow linear segms. which are often lobed at top: fls. orange, about ½in. across, the outer petals with prominent side lobes. Medit. region to Asia Minor. L. H. B.

HYPÉRICUM (*Hypereikon,* ancient Greek name of a plant, of obscure meaning, possibly derived from *ereike,* heather, with the prefix *hypo,* beneath). *Hypericàceæ,* often united with *Guttiferæ.* St. John's-Wort. Ornamental shrubby or herbaceous plants chiefly grown for their bright yellow flowers; planted in the open; often with interesting foliage and habits.

Deciduous, or sometimes evergreen, usually low shrubs, or herbaceous perennials, rarely annual: lvs. opposite, short-petioled or sessile, entire, dotted with pellucid or opaque glands, without stipules: fls. usually in terminal cymes, less often solitary, sometimes axillary, yellow, rarely pink or purplish; sepals 5, imbricate or valvate, often unequal; petals 5, oblique, convolute in bud; stamens usually numerous, free, or connate at the base into 5 or 3 bundles, rarely as few as 3; ovary superior, with 3–5 parietal placentæ, 1–5-celled; styles 3–5, distinct or united: fr. a septicidal caps., rarely a berry; seeds usually cylindric, many, rarely few.—About 200 species in the temperate and subtropical regions of the northern hemisphere, few in the southern hemisphere.

The St. John's worts are exceedingly variable in habit; most species in cultivation are low shrubs, either upright with ascending or spreading branches, or tufted or procumbent; the herbaceous species have often stiff upright wand-like stems or are diffuse or procumbent: the leaves are usually narrow and rather small; the yellow, rarely pink or purplish flowers appear usually in profusion during the summer in terminal clusters, less often solitary, sometimes axillary and forming leafy racemes or panicles; they vary from ⅕ inch to 3 inches in diameter; the capsular fruits are inconspicuous or even unsightly when ripe, only the fruits of the one berry-bearing species are ornamental. Most of the species are tender in the North. *H. aureum, H. prolificum, H. lobocarpum,* and other American species, also *H. calycinum* and *H. patulum* var. *Henryi,* with some protection, have provod hardy as far north as Massachusetts, and *H. Kalmianum* and *H. Ascyron* are still hardy in Canada. Others like *H. patulum, H. Hookerianum, H. Moserianum, H. chinense* can be relied upon only south of New York. *H. floribundum* is doing well in California and so will probably the other Mediterranean species.

They thrive in any good loamy soil, and also in sandy soil, if sufficiently moist; most of them prefer partly shaded situations and bloom longer if not exposed to the full sun. They are, as a rule, short-lived plants and ought to be renewed when they show signs of exhaustion. The larger kinds are well adapted for borders of shrubberies and form round rather dense bushes when standing alone, while those like *H. calycinum, H. Buckleii* and *H. adpressum* are suited for low borders or as a ground-cover, particularly *H. calycinum* which spreads rapidly by suckers. Many of the low tufted or prostrate species enumerated in the supplementary list are handsome plants for rockeries where the more tender species can be so planted as to be easily protected during the winter. Propagation is by seeds, which germinate readily, the shrubby species also by greenwood cuttings under glass in summer; the creeping kinds as *H. calycinum* and some herbaceous species also by division and suckers.

INDEX.

adpressum, 17.
Androsæmum, 23.
Ascyron, 1.
aureum, 14.
axillare, 12.
Buckleii, 16.
calycinum, 2.
cernuum, 3.
chinense, 4.
cistifolium, 18.
densiflorum, 11.
elatum, 22.
fastigiatum, 17.
floribundum, 20.
foliosum, 13.
galioides, 12.
glomeratum, 10.
grandifolium, 22.
Henryi, 6.
hircinum, 21.
Hookerianum, 5.
Kalmianum, 9.
Leschenaultii, 5.
lobocarpum, 8.
minor, 21.
monogynum, 4.
Moserianum, 7.
multiflorum, 22.
nepalense, 6.
nudiflorum, 15.
oblongifolium, 3, 5, 6.
patulum, 6.
perforatum, 19.
prolificum, 11, 13, 14.
pumilum, 21.
pyramidatum, 1.
sphærocarpum, 18.
tricolor, 7.
triflorum, 5.
uralum, 6.
Vilmorinii, 1.
virginicum, 24.
Webbianum, 22.

KEY TO THE SPECIES.

A. *Fls. yellow.*
B. *Number of styles 5.*
C. *Plants herbaceous, 2–6 ft.* ..... 1. **Ascyron**
CC. *Plants shrubby.*

DD. *Lvs. ovate to ovate-lanceolate: fls. 1–3 in. across; stamens in 5 fascicles.*
E. *Height 1 ft. or less, suffruticose, stoloniferous: fls. solitary* ..... 2. **calycinum**
EE. *Height 1–6 ft., shrubby.*
F. *Styles twice as long as ovary: branchlets terete.*
G. *Sepals unequal; styles distinct* ..... 3. **cernuum**
GG. *Sepals nearly equal; styles connate nearly to the apex* ..... 4. **chinense**
FF. *Styles as long or shorter than ovary.*
G. *Branches terete* ..... 5. **Hookerianum**
GG. *Branches 2-edged.*
H. *Calyx with suborbicular nearly equal sepals* ..... 6. **patulum**
HH. *Calyx with oval to oblong, unequal sepals* ..... 7. **Moserianum**
DD. *Lvs. linear-oblong to lanceolate: fls. ⅓–1 in. across; stamens all distinct.*
E. *Cymes many-fld.; fls. ⅓–½ in. across* ..... 8. **lobocarpum**
EE. *Cymes few-fld.; fls. ½–1 in. across* ..... 9. **Kalmianum**
BB. *Number of styles 3.*
C. *Fr. a caps.*
D. *Stamens and styles shorter than petals; styles more or less united; stamens all distinct.*
E. *Growth shrubby.*
F. *Lf.-blades narrowly oblong to linear.*
G. *Cymes forming a terminal corymb.*
H. *Lvs. sessile: caps. incompletely 3-celled* .. 10. **glomeratum**
HH. *Lvs. short-petioled: caps. completely 3-celled* ..... 11. **densiflorum**
GG. *Cymes axillary, forming a narrow elongated panicle.*
H. *Fls. ½in. across: lvs. narrowly linear* .... 12. **galioides**
HH. *Fls. ½–1 in. across: lvs. narrowly oblong* ..... 13. **prolificum**
FF. *Lf.-blades ovate to oblong.*
G. *Caps. incompletely 3-celled: height 1–4 ft.*
H. *Size of fls. 1–2 in.: lvs. short-petioled* ... 14. **aureum**
HH. *Size of fls. ½–¾ in.: lvs. sessile* ..... 15. **nudiflorum**
GG. *Caps. completely 3-celled: height 1 ft. or less* ..... 16. **Buckleii**
EE. *Growth herbaceous or suffruticose.*
F. *Sts. 2-edged: caps. ovoid, incompletely 3-celled* .... 17. **adpressum**
FF. *Sts. 4-angled: caps. subglobose, 1-celled* ..... 18. **cistifolium**
DD. *Stamens about as long as petals; styles distinct; stamens in 3–5 fascicles.*
E. *Plant herbaceous: fls. ½–1 in. across* ..... 19. **perforatum**
EE. *Plant shrubby: fls. 1–2 in. across.*
F. *Branches terete* ..... 20. **floribundum**
FF. *Branches 2-edged.*
G. *Fls. solitary or 3: odor of plant goat-like* ..... 21. **hircinum**
GG. *Fls. in 3–7-fld. cymes* .... 22. **elatum**
CC. *Fr. a black berry: styles distinct, short* ..... 23. **Androsæmum**
AA. *Fls. pink or purplish; stamens mostly 9, in 3 fascicles* ..... 24. **virginicum**

Section Roscyna.

1. **Áscyron,** Linn. (*H. pyramidàtum,* Dry.). Upright perennial, 2–6 ft. high, with tetragonal sts.: lvs. clasping, ovate-oblong or ovate-lanceolate, acutish, 2–5 in. long: cymes terminal, 3–12-fld., appearing in July; fls. 1–2½ in. diam.; sepals ovate to ovate-oblong, unequal; petals thin, narrowly obovate or oblanceolate, curiously shaped and twisted, persistent until withered; stamens in 5 clusters; styles somewhat spreading; stigmas capitate: caps. ovoid, ¾in. long. N. E. N. Amer., Cent. and E. Asia. B.B. (ed. 2) 2:529.—A somewhat coarse plant and toward fall apt to be unsightly through the lower lvs. dying and remaining. Var. **Vilmorínii,** Rehd. Fls. 3–4 in. across. Recently raised by M. L. de Vilmorin from seeds obtained from Korea. B.M. 8557.

Section Eremanthe.

2. **calycìnum,** Linn. Rose of Sharon. Aaron's Beard. Fig. 1940. A subshrub, 1 ft. or less high, with many procumbent or ascending 4-angled sts. occurring in thick tufts: lvs. ovate-oblong or oblong, obtuse, evergreen, subcoriaceous, dark green, glaucous below, 2–4 in. long: fls. large, solitary, or 2–3 together, 3 in. diam.; sepals large, obovate, spreading; stamens long and showy, in 5 clusters, with red anthers; styles shorter than the stamens, divergent: caps. ovate, 4 in. long. July–Sept. B.M. 146. G. 25:333. G.W. 1, p. 197.—A rapidly spreading plant, creeping by woody rootstalks completely covering the soil. Used as a ground-cover abroad. Not very hardy in New England, the annual killing back preventing its covering wide stretches, but not destroying its bloom each year, nor its usefulness in the herbaceous border, or in the margin of a shrubbery. May be protected, and its dark, persistent foliage preserved. Thrives in sun and moderate shade.

1940. Hypericum calycinum. (×¼)

3. **cérnuum,** Roxbg. (*H. oblongifòlium,* Choisy). Shrub, to 5 ft., with terete branches: lvs. sessile, narrowly elliptic to ovate-lanceolate, acutish, narrowed at the base, glaucous beneath, 1–3 in. long: fls. pale yellow, nearly white when opening, 2 in. across, long-stalked, nodding, solitary or in cymes of 3–5; sepals acute; petals obovate; stamens little shorter than petals. Himalayas.—Cult. in Calif.

Section Norysca.

4. **chinénse,** Linn. (*H. monógynum,* Willd.). Half-evergreen shrub to 2 ft., with terete branchlets: lvs. sessile, oblong, obtuse, 1½–3 in. long: fls. about 2 in. across; sepals ovate-oblong, obtuse; petals broadly obovate; stamens little shorter than petals; style slender, about ¾in. long, 5-parted at the apex. China. B.M. 334. G.C. III. 1:705.—Tender.

5. **Hookerìanum,** Wight & Arn. (*H. oblongifòlium,* Hook., not Choisy). A rather compact shrub, to 6 ft., with terete bright reddish brown branches: lvs. among the largest of the genus, 1–4 in. long, evergreen, ovate or oblong, sessile, dark blue-green above, pale and glaucous below: corymbs several-fld., of large golden yellow

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fls. in profusion, 2–2½ in. diam.; sepals large, obovate; petals very large, firm, broadly obovate; stamens scarcely half as long as petals; styles recurved, longer than the stamens: caps. broad-ovate, longitudinally furrowed, ¾in. long. Aug. Himalayas. B.M. 4949. Gn. 54, p. 490. G. 3:463. This is one of the most showy species. Var. **Leschenaûltii**, Dyer (*H. triflòrum*, Blume). Of slenderer and more graceful habit: fls. 2½ in. across; sepals acute. Himalayas, Java. Gn. 23:158.

6. **pâtulum**, Thunb. An evergreen spreading shrub, 1½–3 ft. high, with many smooth, purplish, arching 2-edged branches: lvs. ovate-lanceolate or ovate-oblong, acutish, 1½–2 in. long: fls. many, solitary or in cymes, large, 1½–2 in. diam., of good substance; sepals suborbicular, longer than half the petals; styles upright: caps. ovate, more or less longitudinally furrowed, ½in. long. July–Sept. Japan. B.M. 5693. J.H. III. 43:405. Gn.W. 21:95. R.H. 1875:170. Gt. 15:513. Var. **oblongifòlium**, Koehne (*H. oblongifòlium*, Wall.). Lvs. 2–4 in. long, bluish gray beneath, acutish: fls. 1¾in. across; sepals shorter than half the petals. Himalayas. Var. **urâlum**, Koehne (*H. urâlum*, Don. *H. nepalénse*, Hort.). Lvs. about 1 in. long, acute or acutish: fls. ¾–1 in. across; sepals shorter than half the petals. Himalayas. B.M. 2375. Gn. 17, p. 53. The name has no connection with the Ural Mts., but is an adaptation of the native name "urala swa." Var. **Hénryi**, Veitch. Lvs. ovate or ovate-oblong, obtuse, 2–3 in. long: fls. 2–2½ in. across; sepals ovate, acute. China. This variety is hardier than the other forms of this species and of more vigorous growth.

7. **Moseriânum**, André. GOLD FLOWER. Hybrid raised by Moser, of France, from *H. patulum* and *H. calycinum*, generally resembling the latter but lacking its coarseness, and surpassing both parents in good qualities. A glabrous subshrub 2 ft. high, erect, with the tips of the branches pendulous: lvs. similar to those of *H. calycinum*, ovate, obtuse and mucronulate, opaque, 2 in. long, dark green above, pale below: infl. with 1–3 fls. to the stalk, which are golden yellow, 2–2¾ in. diam., blooming for some time; sepals foliaceous, unequal, oval to oblong; corolla of broad rounded petals, their color heightened by the many tufted yellow stamens with reddish anthers: caps. top-shaped. July, Aug. R.H. 1889, p. 464. Gn. 54:490. R.B. 16:97. G.C. III. 10:333.—Not hardy in New England, but successful farther south. Not good individually, but good in masses, better adapted to the herbaceous border than the shrubbery. May be used as a pot-plant. Var. **tricolor**. Variegated form of white and green edged with red. Habit like *H. patulum*, but more horizontal, the lvs. smaller and narrower: fls. one-fourth the size of those of *H. Moserianum* but similar. Less hardy. J. 8, p. 186.

Section MYRIANDRA.

8. **lobocárpum**, Gattinger. Upright shrub, to 6 ft.: lvs. oblong-lanceolate or linear-lanceolate, obtuse or barely acute, 1½–2½ in. long: fls. profuse, ⅓–½ in. across, in many-fld., naked cymes, forming a corymbose or elongated panicle; sepals oblong, obtusish; stamens numerous; styles connivent: caps. oblong, 5-angled, furrowed, ¼in. long. Aug. Tenn., where it frequents marshes. G.F. 10:453.

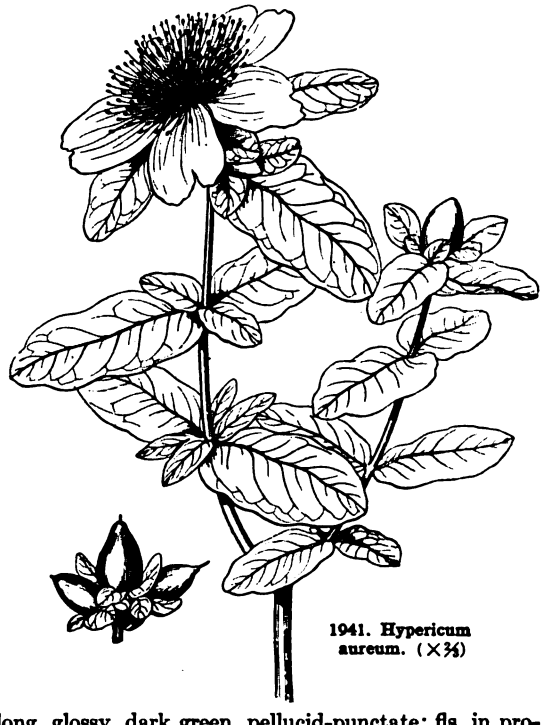
9. **Kalmiânum**, Linn. A shrub, 2–3 ft. high, with rather contorted sts.: lvs. oblong-linear, or oblanceolate, 1–2½ in. long, bluish, more or less glaucous below, crowded: fls. small, ½–1 in. diam., in 3- to several-fld. cymes; sepals foliaceous, oblong, acute; styles united below to form a beak: caps. ovoid, longitudinally furrowed. Aug. Ont. and W. N. Y. to Ill. and Wis. B.M. 8491. G.F. 3:113. Mn. 6:141.—Easily adapted to the garden, succeeding in the shade and enduring considerable dryness. Not so showy in fl. as some other species, but good because of its bright, narrow lvs. and hardiness.

10. **glomeràtum**, Small. Shrub, to 3 ft.: lvs. sessile, narrowly oblong to narrowly linear, apiculate, paler beneath, ¾–1½ in. long: fls. bright yellow, ¾–1 in. across, in dense cymes at the end of the branchlets; sepals rather foliaceous, narrowly oblong, acutish; petals cuneate-spatulate: caps. slightly lobed. Aug. N. C.

11. **densiflòrum**, Pursh (*H. prolíficum* var. *densiflòrum*, Gray). Shrub, to 6 ft.: lvs. short-petioled, linear-oblong to linear, revolute, acute, ½–2 in. long: fls. bright yellow, about ½in. across, in broad and dense, many-fld. corymbs; sepals unequal, oblong to elliptic-oblong: caps. ovoid, slightly 3-lobed. July–Sept. N. J. to Fla., Mo. and Texas. B.B. (ed. 2) 2:530. Mn. 4:97. G.F. 3:527. R.H. 1899, pp. 517, 518.

12. **galioides**, Lam. (*H. axillàre*, Lam., not Michx.). Shrub with slender sts. to 3 ft.: lvs. sessile, ¼–¾in. long, linear, acute, dark green, crowded: fls. yellow, ¼–½in. across, axillary, solitary or in small cymes, forming narrow leafy panicles; sepals linear or linear-spatulate; petals cuneate at the base: caps. conic, acute, furrowed, incompletely 3-celled. July–Sept. Del. to Fla., Mo. and Texas. G.F. 10:433. G.C. III. 24:301.—Forms usually a low round bush with handsome dark green foliage.

13. **prolíficum**, Linn. (*H. foliòsum*, Jacq. *Myriándra prolífica*, Spach). A stout, dense shrub, to 5 ft. high, with exfoliating light brown bark, the twigs 2-angled: lvs. narrowly oblong or oblanceolate, obtuse, 1–3 in. long, glossy, dark green, pellucid-punctate: fls. in profusion, ½–1 in. wide, in several- to many-fld. axillary cymes; sepals obovate; stamens numerous, distinct; styles united at the base: caps. large, oblong, ½in. long, not furrowed. July–Sept. Found in sandy or rocky soil, N. J. to Iowa and Ga.; one of the most commonly cult. G.F. 3:526. W.D. B. 2:88.—A strong, hardy shrub. Grows rapidly in ordinary garden soil, flowering regularly and profusely. Varies greatly in size.



1941. Hypericum aureum. (×¾)

14. **aûreum**, Bartram (*H. prolíficum* var. *aùreum*, Koehne). Fig. 1941. Showy shrub 3 ft. high, more

woody than most species, of stiff, dense habit, top often globular like a miniature tree, with thin, exfoliating red bark, the branchlets 2-edged: lvs. ovate-oblong to oblong, mucronate, bluish, pale below, leathery, 1–3 in. long: fls. sessile, solitary in the native state, in cymes of several in cult., 1–2 in. diam., bright yellow, heightened by the golden filaments at the center; sepals lf.-like, obovate, very unequal, shorter than the thick, broad petals, which persist until withered; stamens distinct, very numerous; styles connate: caps. ovate, acuminate, red, not furrowed, nearly ½in. long. July–Aug. Affects rocky situations when wild, generally shady, where moisture is longest retained, from S. C. to Tenn., Ga. and Texas, but perfectly hardy in Mass. B.M. 8498. Gn. W. 20:934. G.F. 2:185 (adapted in Fig. 1941).—Prop. by seeds and cuttings, young plants from seed blooming the second year.

15. **nudiflòrum,** Michx. Shrub or subshrub, 1–3 ft.: branchlet 4-angled: lvs. sessile, elliptic-oblong to elliptic-lanceolate, obtuse, flat, thin, pale above and below, 1–2½ in. long: fls. light yellow, ½–¾in. across, in naked, peduncled, loose corymbs 2–5 in. broad; sepals elliptic-oblong to elliptic-oblanceolate; styles united: caps. conic-ovate, ¼in. long. July–Aug. N. C. to Fla. and Ala.

16. **Bùckleii,** Curtis. Later written *Buckleyi*. Dense shrub, with slender, 4-angled sts. forming neat, rounded tufts not more than 1 ft. high: lvs. bluish, obovate to elliptic, ¼–1 in. long, rounded at the apex, gradually narrowed at the base, pale below, becoming scarlet in autumn: fls. solitary or in cymes of 3, 1 in. diam.; sepals obovate, obtuse; petals striated and strap-shaped; styles connate: caps. conic-ovoid, about ⅓in. long. June, July. Found only in the highest mountains of the Carolinas and Ga. G.F. 4:581.—Adapted to rockeries and margins of small shrubberies.

17. **adprèssum,** Bart. (*H. fastigiàtum*, Ell.). Practically a herbaceous perennial, erect from a creeping or decumbent base, growing in dense masses, ½–2 ft. tall: lvs. oblong or lanceolate, 1–2 in. long, acute, thin: fl. yellow, ½in. across in several-fld. terminal cymes; sepals lanceolate or ovate-lanceolate: caps. ovoid, slender-beaked. July, Aug. Moist places, Nantucket, Mass. to Ga. and La. B.B. (ed. 2) 2:531.—Spreads rapidly by underground stolons, suggesting occasional use as a ground-cover. Not very hardy in New England.

18. **cistifòlium,** Lam. (*H. sphærocàrpum*, Michx.). Upright perennial or subshrub, with 4-angled sts., 1–3 ft. high: lvs. sessile, often slightly clasping, oblong or linear-oblong, obtuse, revolute, 1–3 in. long: fls. yellow, ½in. across, nearly sessile, in terminal, loose corymbs; sepals ovate to lanceolate: caps. globose to globose-ovoid, 1-celled. July–Sept. Ohio to Ill., Ala., and Ark. B.B. (ed. 2) 2:532.—Satisfactory in light, sandy soil. Spreads rapidly by stoloniferous roots, covering the soil and preventing washing. Not very ornamental. Half-hardy N.

Section EUHYPERICUM.

19. **perforàtum,** Linn. Herbaceous perennial, 1–2 ft., with upright, 2-edged sts.: lvs. sessile, oblong to linear, obtuse, black-dotted, ½–1 in. long: fls. bright yellow, ½–1 in. across, in terminal cymes; sepals acute; stamens in 3 fascicles: caps. ovoid, glandular. June–Sept. Eu., now commonly naturalized in fields and waste places. B.B. (ed. 2) 2:533. R.F.G. 6:343 (5177).

Section WEBBIA.

20. **floribùndum,** Dry. A subshrub, with round, glabrous sts.: lvs. lanceolate-elliptic, rounded at the base; light green; without dots, 1–1½ in. long: fls. in terminal, many-fld. panicles, 1½–2 in. diam., with dilated peduncles; sepals ovate-lanceolate, somewhat acute; stamens numerous, in 3 fascicles, petals and stamens persistent; ovary oval; styles long, divergent, with capitate stigmas. From the Canary and Madeira Isls.—Not hardy N., but in cult. in S. Calif. Grows very rapidly to the height of about 12 ft. or more, but it is usually kept lower by topping it after blooming and thus making it bloom again in about two months. Generally prop. from seeds, which are produced freely.

Section ANDROSÆMUM.

21. **hircìnum,** Linn. Glabrous subshrub of round, compact habit, 2–3 ft. high, the branches winged toward the tips: lvs. sessile, ovate-lanceolate, acute, glandular, 1–2½ in. long, deep green: fls. 1–1½ in. wide, solitary or 3-clustered; sepals lanceolate, deciduous, one-third to one-fourth the length of the lance-oblong petals, which are of a deeper yellow than in the other species; stamens very long, in 5 fascicles; styles spreading, longer than the stamens: caps. ovoid, pointed. July, Aug. W.D.B. 2:86.—Species characterized by the strong, goat-like odor of the lvs. (hence the name). Of easy cult., but requiring a dry position and winter protection. Medit. region. Var. **pùmilum,** Wats. (var. *mìnor*, Lav.). Dwarfer, with smaller lvs. and fls.; as pretty and free-blooming as the type, and, in the rock-garden, preferable. W.D.B. 2:87.

22. **elàtum,** Dry. (*H. grandifòlium*, Choisy. *H. multiflòrum*, Hort., not HBK. *Andrósæmum Webbiànum*, Spach). Shrub or subshrub, 3–4 ft. high, with slightly 2-edged branchlets: lvs. ovate-oblong, acute or obtusish, often subcordate at the base, 1½–3 in. long: fls. 1–1½ in. across, in several- to many-fld. terminal panicles; sepals ovate or ovate-lanceolate, obtuse or sometimes acutish, about ¼in. long; stamens in 5 fascicles; styles longer than ovary: caps. ovate-oblong. July. Canary Isls., Madeira. R.F.G. 6:352. W.&B. 2:85.—*H. multiflòrum*, Hort., has been considered a hybrid between *H. elatum* and *H. Androsæmum*, but the plant cult. at the Arnold Arboretum does not show any influence of the latter species and is apparently only a form of *H. elatum* with more numerous and somewhat smaller fls.

23. **Andrósæmum,** Linn. (*Andrósæmum officinàle*, All.). SWEET AMBER. COMMON TUTSAN. A dense undershrub with erect, 2-edged sts.: lvs. ovate to ovate-oblong, 2–4 in. long, subcordate, minutely dotted, dark green, whitish below: fls. solitary or in cymes of 3–9, large, light yellow, 1 in. across; sepals ovate, ⅓–½in. long; stamens in 5 clusters, longer than the petals; ovary subglobular or oval, incompletely 3-celled; styles divergent, persistent, shorter than ovary: fr. berry-like, blackish violet, the size of a pea. June–Sept. Lives in shady, wet places, W. and S. Eu. to Persia.—Not yet proved hardy at the N. Fls. not particularly attractive, but good in fr. and foliage. All parts very aromatic.

Section ELODEA (Triadenum).

24. **virgìnicum,** Linn. (*Triadènum virgìnicum*, Raf. *Elodèa campanulàta*, Pursh. *Elodèa virgìnica*, Nutt.). MARSH-ST. JOHN'S-WORT. Smooth perennial, 1–1½ ft. high, nearly simple: lvs. numerous, oblong or oval, cordate, clasping, rounded, 1–2½ in. long: fls. ½in. diam., pink- or flesh-colored, in small, close cymes; sepals equal; petals oblong; stamens at least 9 in 3 sets; styles distinct: caps. oblong. July, Aug. In swamps, Labrador to Fla. west to Man., Neb. and La. B.B. (ed. 2) 2:537.—Useful plant for an artificial bog, and thrives well also in any fine, loamy soil in the shade or sun.

H. ægyptiacum, Linn. Dwarf shrub: lvs. crowded, elliptic, acute, ¼–½in. long: fls. solitary, axillary. ½–½in. across, forming leafy racemes; styles 3. Medit. region. B.M. 6481. G.C. II. 14:503. B.R. 196.—*H. Arnoldiànum*, Rehd. (H. galioides × H. lobocarpum). Similar to H. galioides, but with a many-fld. terminal infl. and several-fld. lateral infl.: caps. 3–5-celled. Originated at the Arnold Arboretum.—*H. baleàricum*, Linn. Low upright shrub with the lvs. beneath and the twigs warty: lvs. oval, obtuse, about ½in. long: fls. 1½ in. across, solitary, terminal; styles 5. Medit. region.

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B.M. 137.—*H. canariénse*, Linn. Allied to H. floribundum. Shrub, to 15 ft.: lvs. oblong-lanceolate, narrowed at the base, 2–3 in.: fls. 1–1½ in. across, in panicles; sepals ovate, acute, ciliate. L.B.C. 10:953.—*H. còris*, Linn. Procumbent subshrub, 6–8 in. high: lvs narrowly linear, revolute on the margin, about 1 in. long, in whorls of 4–6: fls. ¾in. across, in few-fld. loose cymes; styles 3. Cent. and S. Eu. B.M. 6563.—*H. cuneàtum*, Poir. Low diffuse subshrub, ½–1 ft. high: lvs. obovate, ¼–½in. long: fls. ¾in. across, axillary, slender-stalked, forming leafy racemes. Asia Minor. —*H. Dawsonidnum*, Rehd. (H. lobocarpum × H. prolificum). Differs from H. prolificum in the more numerous fls. and the 3–5-celled, furrowed caps. Originated at the Arnold Arboretum.—*H. dolabriférme*, Vent. Procumbent perennial, with ascending sts. 6–20 in. high: lvs. linear-lanceolate, ½–1½ in. long: fls. 1 in. across, in terminal leafy corymbs. Ky. and Tenn. B.B. (ed. 2) 2:532.—*H. élegans*, Steph. Upright perennial, ½–1 ft. high.: lvs. ovate-lanceolate, ¾–1 in. long: fls. ¾–1 in. across, in terminal panicles; sepals ovate-lanceolate, glandular-ciliate. Cent. Eu. to Altai Mts. R.F.G. 6:350 (5190).—*H. elòdes*, Huds.=H. helodes, Linn.—*H. empetrifòlium*, Willd. Upright shrub, to 1 ft.: lvs. linear, revolute on the margin, ½–¾in. long, in whorls of 3: fls. ½–¾in. across, in 3–5-fld. cymes forming panicles; sepals broadly oblong. S. E. Eu., Asia Minor. B.M. 6764. Gn. 30, p. 221.—*H fasciculàtum*, Lam. Allied to G. galioides. Shrub, to 6 ft.: lvs. linear, thick, ½–¾ in. long: fls. ½–½ in. across, in narrow panicles. N. C. to Fla. and Texas.—*H. frágile*, Heldr. & Sart. Dwarf subshrub: lvs. ovate, imbricate, ⅛in. long, glaucescent-fls. large, in 3- to many-fld. cymes; sepals linear-lanceolate. Greece.—*H. helòdes*, Linn. Procumbent perennial, with orbicular-ovate, villous lvs. ½–¾in. long: fls. pale yellow, about ½in. across; in few-fld. terminal cymes. Eu. R.F.G. 6:342 (5182). Suitable for boggy places.—*H. inodòrum*, Willd. (H. ramosissimum, Ledeb.). Allied to H. hircinum, but without the goat-like odor. Arching shrub, with strongly 2-edged branchlets: lvs. ovate to ovate-oblong, 1½–2 in. long: fls. 1 in. across, in few-fld. dense corymbs. Caucasus.—*H. japónicum*, Thunb. Decumbent perennial, with ovate or oval 3-nerved lvs. and 4-angled sts.: fls. ½in. across, with petals equaling the lanceolate sepals, in terminal cymes. E. Asia to Austral. Scarcely ornamental.—*H. lysimachioides*, Wall. Slender shrub, with slightly angular arching branchlets: lvs. ovate to ovate-oblong, acute, 1–1½ in. long: fls. 1 in. across in loose leafy cymes; sepals linear-lanceolate; styles 5. Himalayas. V.F. 25.—*H. montànum*, Linn. Perennial: lower lvs. larger, ovate, glabrous: fls. in close compact cymes, often reduced to a head. Cent. and S. Eu.—*H. napaulénse*, Choisy (H. nepalensis, Hort.). Trailing subshrub with ovate to ovate-lanceolate lvs. ½–¾in. long: fls. ½in. across in few-fld. loose cymes. Himalayas.—For H. nepalense, Hort., see also No. 6.—*H. nóthum*, Rehd. (H. densiflorum × H. Kalmianum). Similar to H. densiflorum, but fls. less numerous, lvs. narrower and caps. 3–5-celled, slightly furrowed. Originated at the Arnold Arboretum.—*H. nummulàrium*, Linn. Diffuse ascending subshrub: lvs. roundish, ⅓–½in. long: fls. ¾in. across, in terminal cymes; sepals glandular-ciliate. Pyrenees. R.F.G. 6:346 (5184).—*H. olýmpicum*, Linn. Upright or ascending subshrub, 1 ft.: lvs. oblong-lanceolate, grayish green, ½–1½ in. long: fls. golden yellow, 1½–2½ in. across, in terminal few-fld. corymbs; sepals large, pointed; petals oblong-obovate. S. E. Eu., Asia Minor. B.M. 1867. Gn. 31:302.—*H. opàcum*, Torr. & Gray. Allied to H. sphærocarpum. Subshrub, 1–3 ft.: lvs. oblong-lanceolate, ½–1 in. long: fls. ½in. across, in open corymbs; sepals obtuse: caps. ovoid. S. C. to Fla. and Miss. G.F. 5:305.—*H. orientàle*, Linn. Upright perennial, ½–1 ft.: lvs. obovate-oblong to linear-oblong, obtuse, glandular-ciliate, ½–1 in. long: fls. 1 in. across, in small terminal cymes. Asia Minor.—*H. polyphýllum*, Boiss. Perennial with ascending sts.: lvs. elliptic-linear, glaucous, ⅓–½ in. long: fls. 1½–2 in. across, in dense terminal cymes. Cilicia.—*H. pilchrum*, Linn. Allied to H. perforatum. Sts. terete: lvs. ovate, clasping, ⅓–½in. long: fls. ½–¾in. across, in terminal panicles; sepals glandular-ciliate. Cent. Eu. R.F.G. 6:347 (5185).—*H. ramosissimum*, Ledeb.=H. inodorum.—*H. rèpens*, Linn. Perennial, with prostrate sts.: lvs. oblong or linear-oblong, ¼–½in. long: fls. golden yellow, 1 in. across in few-fld. terminal cymes. S. E. Eu., Asia Minor. S.F.G. 8:775.—*H. réptans*, Hook. f. & Thoms. Prostrate shrub, with rooting sts.: lvs. elliptic-oblong, ¼–½in. long: fls. cup-shaped, solitary, terminal, 1¾in. across; petals broadly obovate; styles 5. Himalayas. Gn. 24, p. 267; 30, p. 221. —*H. salicifólium*, Sieb. & Zucc. Allied to H. chinense, but distinguished by the narrower acute lvs., many-fld. corymbs and acute sepals. Japan.—*H. spléndens*, Small. Allied to H. aureum. Shrub, to 5 ft.: lvs. oblong, ¾–1 in. long: fls. pedicelled, 1½ in. across, in several- to many-fld. cymes; stamens orange-colored: caps. with 3 narrow wings. Ga. Seems not yet in cult.; very desirable.—*H. tomentòsum*, Linn. Perennial with ascending sts.: lvs. ovate, woolly, ½–¾in. long: fls. ½–¾in. across, in many-fld. corymbs; sepals ciliate, acute. Eu. R.F.G. 6:346 (5183).—*H. túrgidum*, Small. Allied to H. sphærocarpum. Shrub, 1–2 ft.: lvs. linear-oblanceolate, ½–1 in. long: fls. 1 in. across in several-fld. cymes; sepals ovate to elliptic: caps. subglobose, broadest at the top. Ala.

ALFRED REHDER.†

HYPHÆNE (Greek, *to entwine;* referring to the fibers of the fruit). *Palmàceæ*, tribe *Borásseæ*. Fan-leaved unarmed palms of moderate or tall stature from tropical Africa and Madagascar.

Caudex robust, cylindrical, ventricose or pear-shaped, simple or forkingly branched: lvs. terminal, orbicular, palmate-flabelliform, plicate-multifid; segms. ensiform, acute or 2-fid, margins induplicate with fibers interposed; rachis short; petiole strongly biconvex or a trifle flatter above; margins minutely spiny; ligule short, rotund; sheath short, open: fls. dicœcious, in relatively deep pits, on the infl., which is partly hidden by the lvs.—About 10 species from Trop. Afr. The Borassus tribe of palms consists of Borassus, Lodoicea, Latania and Hyphæne. In the first two the staminate fls. in the pits of the spadix are numerous; in the last two they are solitary. In the first and fourth there are few stamens; in the second and third the stamens are numerous.

crinìta, Gaertn. (*H. natalénsis*, Kunze). Young fronds 1 to 1½ ft. long, lanceolate, bi- or trifid at the apex, bright green, clothed on both sides with a white bloom which soon vanishes, plicate, scabrous on the margins and nerves above; petiole sheathed for 1 or 2 in., deeply channelled above, rough on the margins: frs. obovate, 2½ in. long, smooth. S. Afr.—Cult. outdoors in S. Fla. Does not look at all like Latania. It has long, thick seed-lvs., and, it is said, has withstood the cold in Fla. better than any other palm. It is extremely slow of growth, and cannot be desirable as a house plant. It is probably cult. more in northern conservatories than in the S.

H. Thebàica, Mart. A showy palm with striking yellow-orange frs. is probably a Corypha. It is little cult. in N. Amer. F.S. 21:2152–3.—*H. ventricòsa*, Kirk, is a showy blue-green palm with an immense cluster of lvs. and a bulging trunk. Congo. Not in cult. in Amer. G. C. II. 21:649.

N. TAYLOR.†

HYPOCHÆRIS (old name, of doubtful origin). *Compósitæ*. Sometimes written with the digraph æ. Perhaps 50 herbs, of the Medit. region, N. Asia and the southern part of S. Amer., allied to Leontodon, scarcely cult. They are annual or perennial, more or less branched, yellow-fld.: lvs mostly radical: involucre campanulate, the scales marginless; receptacle with narrow bracts: achenes 10-ribbed, some or all tapering into a beak; pappus of many fine plumose bristles; heads homogamous, the florets ligulate. **H. unifìora,** Vill. (*Achyróphorus helvéticus*, Scop. & Less.), has been offered in N. Amer.: perennial: radical lvs. oblong-lanceolate, dentate, hirsute; cauline lvs. 1–2: st. simple, 1-headed or sometimes 2–3-headed under cult.: involucre very hairy: achenes beaked. Mountains of Eu., and useful in alpine- and rock-gardening. L. H. B.

HYPOCÝRTA (name refers to the gibbous or *curved beneath* corolla-tube). *Gesneriàceæ*. Shrubby, erect, creeping or climbing, natives of tropical America of perhaps ten species. They are little known in cultivation; require the handling of Gesneria and similar plants. *H. grácilis*, Mast.=*Codonanthe gracilis*.

HYPÓLEPIS (Greek, *a scale underneath*). *Polypodiàceæ*. Tropical glasshouse ferns of both hemispheres rarely cult. Allied to Cheilanthes: rhizomes long and creeping, the fronds herbaceous: distinguished particularly by the marginal sori, placed in the sinuses of the lf., and covered with the membranous lf.-margin.—Ten or more species are known. (See p. 1215.)

rèpens, Presl. Lf.-stalks straw-colored, more or less prickly; lf.-blades 3–4 ft. long, quadripinnatifid; lower pinnæ 1–2 ft. long, 6–12 in. wide, ovate-acuminate; sori 2–6 to a segm. W. Indies to Brazil.—A rather coarse fern, of easy cult., with the general appearance of a cyathea. Like all strong-growing ferns, it requires a large percentage of loam. It likes shade and moisture at all times, and is readily prop. by spores, which it produces in great quantity, being often self-sown. It requires a stove or intermediate temperature.

H. califórnica, Hook. See Cheilanthes californica.—*H. meifólia*, Baker. See Cheilanthes meifolia.

L. M. UNDERWOOD.

HYPOLÝTRUM (from the Greek for *beneath* and a *sheath;* in reference to the 2 or 3 scales found under the true scale). *Cyperàceæ*. Perennial herbs with leafy sts.,

often very strong and coarse: spikelets numerous and small in compound panicles that have long leafy involucral bracts; glumes imbricate around the rachis; stamens 3 or less: fr. a hard 3-angled nutlet.—Species 25 or 30, in tropical and subtropical regions of both hemispheres. Only one species seems to be in the trade. **H. Schraderiànum,** Nees, is listed abroad, apparently as a greenhouse plant, the lvs., "crowded in bold triangular tufts, green with purplish red margins, traversed on the upper surface by 2 ribs running equidistant from base to apex," giving it a striking and ornamental effect: panicle much decompound; spikelets obovate-elliptic: lvs. linear-lanceolate, 3-nerved, the margin and midnerve more or less serrulate-scabrous toward the apex, 2 ft. long and 1½ in. or less wide: culms 5–6 ft. In woods and swamps, Brazil. L. H. B.

1942. Hypoxis hirsuta.

HYPÓXIS (old Greek name, of no application to these plants). *Amaryllidàceæ.* STAR-GRASS. About 50 species of little herbs of temperate and tropical regions, with linear lvs., hard rootstocks or corms, perianth adnate to the ovary, and anthers not versatile: stemless: fls. few, on slender scapes. They are scarcely known in cult., although the common species of the northern states, **H. hirsùta,** Coville (*H. erécta,* Linn.), Fig. 1942, is offered by dealers in native plants. The lvs. are radical, hairy, grass-like: fls. 1–6, small, star-like, bright yellow, on scapes 4–10 in. tall. Give a half-shady place in the rockery or border. Prop. by division. Blooms in spring. Not showy, but interesting. **H. stellàta,** Linn. f., from S. Afr., is a pretty greenhouse bulb, blooming in Dec.: lvs. 4–12, glabrous, a foot or less long: peduncles sometimes forked, 1–4, bearing fls. white inside, and the outer segms. green-striped on the back: corm globose: plant variable. L. H. B.

HÝSSOPUS (ancient name; but precisely what plant was the sacred Hyssop of the Jews is uncertain). *Labiàtæ.* HYSSOP. A familiar plant, cultivated for medicine and also for ornament in hardy borders.

It is considered a genus of only 1 species, the numerous synonyms being referred mostly to *H. officinalis* or to the genus Lophanthus, 2 species of which are cult. Hyssopus has entire lvs.: Lophanthus has serrate lvs. Important generic characters of Hyssopus are the 15-nerved tubular calyx, divergent stamens, upper lip of corolla 2-lobed, lower 3-lobed, stamens 4, didynamous, nutlets ovoid and smooth and somewhat 3-sided.

officinàlis, Linn. Fig. 1943. Sts. herbaceous from a woody base, slender, branched or not: lvs. linear to oblong, sessile or nearly so, acute at both ends or the lower ones obtuse at the apex, 1½–2 in. long. Eu. and Temp. Asia; also run wild in this country. B.M. 2299 (as *H. orientalis*). Var. **álba,** with white fls., is cult. Var. **grandiflòrus,** Hort., from Lake Baikal, has large open fls., a diffuse habit and a lax arrangement of the whorls of fls.

Hyssop is a hardy perennial subshrub, 18 inches tall. The whole plant has a strong odor and pungent, bitter taste. The green parts are used in connection with wormwood and other plants in the manufacture of absinthe, occasionally as a pot-herb, and as a flavoring for cold-salad plants. The powdered, dried flowers are similarly employed in soups. The flower-spikes are cut just as the blossoms begin to open, and are dried for use in domestic medicine as a stimulant and expectorant in the treatment of asthma, coughs and other pulmonary troubles. Hyssop is not now so highly esteemed as formerly by the medical profession.

This plant is readily propagated by seeds, cuttings and plant-division. The seed, generally employed in cold climates, is sown in early spring, either in drills 15 to 18 inches apart where the plants are to remain, or broadcast in nursery beds for transplanting, 12 inches apart in June or July. Propagation by cuttings and by divisions may be done in the autumn, but better in the spring, when the plants first start to grow. Greenwood cuttings may be started in the shade in the early summer. They need to be well watered. The soil should be a light, mellow, calcareous or sandy loam, with a warm aspect. Culture and harvesting are the same as for sage, mint and other herbs. The beds should be renewed every three or four years. M. G. KAINS.

1943. Hyssop.—Hyssopus officinalis. (×½)

HÝSTRIX (Greek, from *hustrix,* a porcupine). *Gramíneæ.* Perennials with simple culms, flat blades and loosely fld. spikes: spikelets 2–4-fld., nearly sessile, 1–3 together at each joint of a zigzag rachis as in Elymus, widely divergent at maturity; glumes 1 or 2 short awns; lemmas rigid, tapering into a long awn.—Species 4, N. Amer. and Eurasia. *H. pátula,* Moench (*Asprélla Hýstrix,* Willd.). BOTTLE-BRUSH GRASS is found in E. U. S. and is sometimes used for lawn decoration and for borders. Dept. Agric., Div. Agrost. 20:168.

A. S. HITCHCOCK.

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I

IBÈRIS (from *Iberia*, the ancient name of Spain, where many species occur). *Cruciferæ*. CANDYTUFT. Small flower-garden and border plants.

Annual, biennial or perennial, sometimes half-shrubby, usually glabrous but sometimes ciliate or even hairy: lvs. alternate, entire or pinnatifid, sometimes fleshy: fls. racemose or corymbose, white or purplish, the outer ones in the dense cluster more or less radiate; sepals 4, deciduous; petals 4, the 2 outer much larger than the others; stamens 4, free, not appendaged: fr. a scale-shaped roundish or ovate pod which is margined or winged and often notched at the top, plano-compressed; seeds single in each locule, ovate, not margined.—Species 30–40, native to S. Eu., W. Asia and N. Afr., all low-growing plants. Comparatively few species are cult. The annuals are the common candytuft of gardens. The biennials are not cult. The subshrubs are flat, dwarf, compact, commonly evergreen plants, with dark green lvs., completely covered with broad, flat or elongated clusters of irregular cruciferous fls. in spring. The common white-fld. annual candytuft is *I. amara*. The common annual kinds with colored fls. are *I. umbellata*. The common perennial kind is *I. sempervirens*. The clusters of some kinds remain rather flat-topped when they run to seed, while the clusters of other kinds lengthen after flowering; these differences are made division points in the arrangement of species, following.

1944. Iberis gibraltarica. (×½)

The annuals are showy branching plants, 6 to 18 inches high, much grown in masses in beds or for edging. Florists grow them also, especially the white varieties, for cut-flowers. They are of easy cultivation, and succeed in any rich garden soil, in a place exposed to light and air. They are propagated by seeds, which may be sown at any season, in the house or open ground, but particularly in the fall when the climate permits, or as early as possible in spring, in rows 6 to 8 inches apart where the plants are to grow, the plants being thinned later to 4 inches apart in the row. The finest display is attained from autumn-sown plants, which flower from May to July. If seed is sown in autumn, the plants should be slightly protected from the sun during winter. Seeds sown early in the spring bloom from July to September. Continuous bloom may be obtained by sowing every two weeks. Good results are attained by sowing under glass and transplanting into open ground when the soil is warm. To secure the best bloom, the plants should be given much room, and never crowded. The name candytuft was given because the flowers appear in tufts and because the first introduced species, *I. umbellata*, was brought from Candia.—The subshrubby species are adapted to the front of shrubberies, where they connect taller plants with the surrounding lawn. They may appear in separate clumps, in broad masses, or may mingle with other genera in the herbaceous border. They are suited to rockeries, and hang well over walls and ledges. They are to be treated much like herbaceous perennials. They are plants of refinement, and are pleasing when close to the observer. They are useful and popular for cut-flowers, are easily forced into bloom in winter, and are adapted to pot and pan culture. They are easily propagated. The perennial iberis succeed best when let alone. Once planted and not disturbed, they soon form a dense foliage. They are the best spreading, dwarf plants with white flowers. (A. Phelps Wyman.)

INDEX.

affinis, 2.
alba, 9.
amara, 1.
carminea, 9.
carnea, 9.
corifolia, 6.
coronaria, 1.
Dunnettii, 9.
foliis variegatis, 5, 12.
Garrexiana, 7.
gibraltarica, 8.
hybrida, 8, 9.
lilacina, 9.
nana, 9.
odorata, 3.
pectinata, 2.
petræa, 10.
pinnata, 4.
plena, 5, 12.
Prultii, 11.
pumila, 9.
pupurea, 9.
rosea, 5, 9.
saxatilis, 6.
semperflorens, 12.
sempervirens, 5.
superba, 5.
Tenoreana, 10.
umbellata, 9.

A. *Infl. racemose in fr.*

B. *Annuals or biennials: sts. not woody at the base.*

C. *Lobes of the pod erect.*

1. **amàra,** Linn. COMMON ANNUAL CANDYTUFT. Plant erect, stiffish, 6–12 in., very bitter: lvs. lanceolate, toothed toward apex: fls. white, the clusters at first short but afterward elongating: pod nearly orbicular. Common weed of cult. ground in Great Britain and Cent. and S. Eu. The best form is var. **coronària,** Voss (*I. coronària*, Hort., not D. Don). ROCKET CANDYTUFT. This has larger and fuller clusters and larger fls. The taller varieties, Empress, Spiral White, and Giant Snowflake, grow 18 in. high, with solid pyramidal trusses 5–8 in. long. Dwarf forms are Tom Thumb and Little Prince. All are good bedders, and Empress is excellent for cutting. Seed may be sown at any time, but the best results with Empress are secured by sowing under glass and transplanting to the open, where plants will bloom in May and June.

2. **pectinàta,** Boiss. (*I. affinis*, Hort., not Jord.). Lvs. pectinate (i.e., divisions deeper, narrower, and farther apart): fls. white. Spain. —Advertised only as *A. affinis*. Likely to be confused with *I. odorata*, but the petals are 4 times as long as the calyx and the pods have short hairs, while in *I. odorata* the petals are 1½ times as long as the calyx and the pods glabrous.

CC. *Lobes of the pod spreading.*

3. **odoràta,** Linn. SWEET-SCENTED or FRAGRANT CANDYTUFT. Annual, 6–12 in.: lvs. linear, wider toward the top, toothed, ciliate toward base: fls. white, fragrant. Greece, Syria.—Frequently confused with *I. pinnata*. Said to be better and more fragrant in poor soil.

4. **pinnàta,** Linn. Annual or biennial, with oblong-linear pinnatifid or pinnatisect lvs., the segms. being very narrow: 12 in. or less: fls. white, fragrant; infl. only slightly elongated in fr. and therefore sometimes described as corymbose. Spain, S. France, Italy.—Said to be often sold as *I. odorata*.

BB. *Perennials: sts. woody at the base.*

C. *While in flower, racemose.*

5. **sempérvirens,** Linn. Perennial, to 1 ft., branching, somewhat shrubby: lvs. oblong, obtuse, narrowed at base, glabrous: fls. white, in elongating racemes. S. Eu. Gng. 2:145 (fine habit sketch). F.R. 1:75 (poor). G.W. 8, p. 373. Var. **plèna,** a double form, is cult., but is less desirable. Var. **rôsea** and var. **fôliis variegâtis,** are sold abroad. Var. **supérba,** or Perfection, is said to be one of the best forms.—This is the commonest, hardiest and most permanent of the perennial kinds. When the rarer and tenderer kinds are winter-killed, *I. sempervirens* is likely to spread out and surround the labels of other kinds. This probably explains why some of the most reliable dealers have sold this plant under other names, particularly *I. gibraltarica.*

CC. *While in flower, corymbose.*

D. *Margin of lvs. entire.*

6. **saxátilis,** Linn. Perennial, dwarf, evergreen, 6 in. or less, with ascending sts.: lvs. linear, entire and somewhat fleshy, mostly ciliate: fls. white, corymbose. S. Eu. Var. **corifôlia,** Sims (*I. corifôlia,* Sweet). Lvs. glabrous: fls. white. B.M. 1642, although this picture was doubtfully referred by Baker to *I. Garrexiana.* G.M. 46:289.

1945. Iberis Tenoreana var. petræa.

7. **Garrexiàna,** All., not Scop. Lvs. oblong, narrow at the base, glabrous: fls. rather small, white, the racemes much elongating. Piedmont, Pyrenees. Referred by some to *I. sempervirens.* Intermediate between *I. sempervirens* and *I. saxatilis,* having the habit of the latter. It is sometimes described as *I. sempervirens* var. *Garrexiana.* Gn. 62, p. 393. G.M. 48:211.

DD. *Margin of lvs. toothed toward apex.*

8. **gibraltárica,** Linn. Fig. 1944. Perennial, evergreen, diffuse, 12–20 in.: lvs. wedge-shaped, obtuse, subciliate: outer fls. pink, inner ones white. Spain, Morocco. B.M. 124. G.C. III. 46:158. Gn. 10:288; 76, p. 69. G. 27:446. R.H. 1870:330. Gn. 24, p. 549, same as R. H. 1885, p. 446.—This is considered by some as the most striking and showy of the perennial kinds. It grows higher and more erect, with larger clusters and larger fls., but is less hardy than the others. This is much sought after, and the stock in the nurseries is often not true to name. Var. **hýbrida,** is advertised, the fls. white shading to lilac.

AA. *Infl. corymbose in fr.*

B. *Annuals: sts. not woody at the base.*

9. **umbellàta,** Linn. Common Annual Candytuft. Upright, 6–15 in.: lvs. lanceolate, acuminate, lower ones serrate, upper ones entire: fls. in the wild typically purplish, rarely white, in umbels terminating all the main sts.: pods acutely 2-lobed. Italy, Crete, Spain. B.M. 106.—This is the common hardy annual candytuft with colored fls., the colors being more numerous and better fixed than in any other species. Trade names are vars. **carmínea, cárnea, lilácina** and **Dúnnettii** (*I. Dúnnettii,* Hort.), the last being dark purple. Vars. **rôsea, purpûrea** and **álba** are advertised abroad, also vars. **nàna, pûmila** and **hýbrida.** Tall and dwarf forms of all the colors are procurable.

BB. *Perennials: sts. woody at the base.*

C. *Lvs. ciliate, crenate.*

10. **Tenoreàna,** DC. Perennial, somewhat shrubby at base, ascending, about 6 in. high: lower lvs. obovate, narrowed at base; upper lvs. oblong-linear: fls. purplish or whitish, the clusters flattish and not elongating: pods notched at apex. Naples. B.M. 2783. L.B.C. 18:1721. G. 34:119.—According to Baker (G.C. 1868: 711), this is the only perennial kind that is decidedly hairy. DeCandolle says the lvs. are puberulous. Var. **petræa,** Nichols. (*I. petræa,* Jord.). Fig. 1945. A good rock-garden form, with fls. white tinged red in center.

CC. *Lvs. not ciliate, entire or subdentate.*

11. **Prûitii,** Tineo. Perennial, 6 in., woody at base: lvs. glabrous, obovate-spatulate, entire or subdentate: fls. white, in compact clusters: pods merely notched at apex; seed not margined, the radicle descending; septum of pod simple. Sicily.

12. **semperflôrens,** Linn. Perennial, evergreen, 1–2 ft.: lvs. wedge-shaped or spatulate, obtuse, entire, glabrous, somewhat fleshy: fls. large, pure white, fragrant: pods scarcely notched at apex; seed somewhat margined, the radicle horizontal; septum of pod nearly double. Sicily and perhaps Persia. Var. **plèna,** a double variety. Var. **fôliis variegâtis** said to be cult. abroad.

I. cordifôlia is an error for I. corifolia.—*I. correæfôlia,* Hort., is a common trade name abroad, which is usually spelled, I. correæfolia in American catalogues. There is no genus Corra, and Correa is an Australian plant of the Rutaceæ. Specimens should therefore be compared with I. saxatilis var. corifolia. Mottet's description, however, would place this plant directly after I. Garrexiana in the key, being distinguished from I. Garrexiana by the fls. becoming purplish instead of always remaining white. Mottet says that I. correæfolia, Hort., is a hybrid, with spatulate, entire, obtuse lvs.—*I hyacinthiflôra,* Hort., is an annual candytuft with milk-white fls. in elongated panicles. It is said to be a first-quality cut-fl. for summer bloom.—*I. jucúnda,* Schott & Kotschy=Æthionema coridifolium.—*I. Lagascàna,* DC. Annual, 1 ft.: lvs. oblong-spatulate, toothed at apex: fls. pure white, in close corymbs: pods 2-lobed. Spain.—*I. lilácina* of trade catalogues is presumably a lilac-fld. variety of I. umbellata.—*I. nàna hýbrida,* Hort., is not I. nana, All., a distinct botanical species, but a trade name of mixed dwarf varieties of some common annual kind, presumably I. umbellata.

Wilhelm Miller.
L. H. B.†

IBÍDIUM (named from the fancied resemblance of the anther to the beak of an ibis). *Orchidàceæ.* By some authors used to supplant the generic name Spiranthes (which see), but the latter name is retained by the "nomina conservanda" of the Vienna code. Under Ibidium, the nomenclature becomes:

I. coloratum, House (*Spiranthes colorata,* N.E. Br.);

I. cernuum, House (*Spiranthes cernua,* Rich.);

I. Romanzoffianum, House (*Spiranthes Romanzoffiana,* Cham.);

I. plantagineum, House (*Neottia plantaginea,* Raf. *Neottia lucida,* H. H. Eaton. *Spiranthes latifolia,* Torr. *S. lucida,* Ames);

I. præcox, House (*Spiranthes præcox,* Wats.);

I. Beckii, House (*Spiranthes Beckii,* Lindl. *S. simplex,* Gray. *S. Grayi,* Ames);

I. gracile, House (*Neottia gracilis,* Bigel. *Spiranthes gracilis,* Beck);

I. vernale, House (*Spiranthes vernalis,* Engelm. & Gray). Lvs. oblong-lanceolate to linear-lanceolate, tapering to both ends, ¼in. wide or less, mostly basal, the lower ones usually withering before flowering time: scape densely pubescent above; floral-bracts longer than the ovaries, with hyaline margins; raceme slender, 1-ranked, 1–3 in. long; fls. ⅛in. long, yellowish, lip ovate to ovate-oblong, pubescent beneath. Mass. to Fla., Ill. and Kans.

H. D. House.

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ICACÒREA: *Ardisia.*

IDÈSIA (Yobrants Ides, Dutch traveler in China). *Flacourtiàceæ.* Ornamental tree grown for its handsome large foliage and also for the attractive orange-red berries.

Deciduous: lvs. alternate, long-petioled, 3–5-nerved at the base, crenate-serrate; stipules small, caducous: fls. dicœcious, in large terminal panicles; sepals 5 (3–6); petals wanting; stamens, numerous, with villous filaments; ovary 1-celled, with 3–6 spreading styles: fr. a many-seeded berry.—One species in S. Japan and Cent. and W. China.

This is a handsome tree with close grayish white bark and spreading branches forming a low broad head; the rather large lustrous leaves are borne on long reddish stalks; the flowers are not showy, but the orange-red berries, borne in pendulous racemes sometimes 10 inches long, are very conspicuous, particularly after the leaves have fallen. The plants raised from seeds recently introduced from Central China have proved hardy at the Arnold Arboretum, at least in favorable positions, while the Japanese plant introduced about fifty years ago is not hardy north of Philadelphia; otherwise there is no difference between the Japanese and the Chinese plant. The tree grows quite rapidly while young and does not seem particular as to the soil. Propagation is by seeds, which germinate readily, and by greenwood and root-cuttings.

polycárpa, Maxim. (*Polycárpa Maximowiczii,* Hort.). Tree, to 50 ft.: lvs. usually cordate-ovate, rarely oblong-ovate, acuminate, remotely crenate-serrate, deep green above, glaucous below, glabrous, 5–10 in. long; petiole 4–6 in. long: fls. greenish yellow, fragrant, in pendulous panicles 4–10 in. long; staminate fls. over ½in. across, pistillate ⅛in. June; fr. in Sept.–Nov. B.M. 6794. Gn. 12, p. 532; 13, p. 99. R.H. 1872, pp. 174, 175; 1888, pp. 463–5. F. 1874, pp. 64, 65. F.S.R. 2, p. 189. J.H.S. 27:410. L.I. 11. S.I.F. 1:76. Gt. 39, p. 40 (habit). F.E. 24:853. G.C. III. 39:13. Var. **vestita,** Diels. Lvs. densely pubescent or tomentose below. W. China. Tender. Var. **crìspa,** Carr. Lvs. irregularly incised and curled. R.H. 1878, p. 254; 1888, p. 463. Gn. 15, p. 471. Var. **fòliis variegàtis,** Hort. Lvs. variegated with sulfur-yellow and gray.

ALFRED REHDER.

ÌLEX (the ancient Latin name of *Quercus Ilex*). Including *Prìnos* and *Othèra. Aquifoliàceæ* (or *Ilicineæ*). HOLLY. Ornamental woody plants, grown for their handsome foliage and the attractive mostly red berries.

Evergreen or deciduous trees or shrubs: lvs. alternate, petioled, with small, caducous stipules, sometimes spiny: fls. dicœcious, usually in rather few-fld. axillary cymes; calyx-lobes, petals and stamens usually 4, sometimes more; ovary superior; style very short: fr. a berry-like drupe, with 2–8 bony 1-seeded stones.—About 275 species in N. and S. Amer., Trop. and Temp. Asia, and few in Afr., Austral. and Eu. Monograph by Loesener in Nov. Act. Leop.-Carol. Acad. 71, pt. 1 (1901). For a horticultural monograph, see Dallimore, Holly, Yew and Box, pp. 1–149 (1909), with many illustrations.

The hollies have medium-sized, simple leaves, small, inconspicuous, whitish flowers in axillary clusters or solitary, and black, red or sometimes yellow berries, remaining on the branches often until the following spring. Of the evergreen species, only *I. glabra* and *I. opaca* are hardy North, and also *I. crenata* in somewhat sheltered positions. *I. Aquifolium, I. Pernyi,* and *I. cornuta* are more tender, but stand many degrees of frost if sheltered, while most of the others can be grown only in the South. Of the deciduous species, *I. decidua, I. monticola, I. lævigata* and *I. verticillata* are hardy North; also *I. serrata* and some other Japanese species are hardy or nearly so. The hollies, especially those with scarlet or red berries, are highly ornamental, and the berried branches of *I. opaca* and *I. Aquifolium* are in great demand for Christmas decoration. Also *I. lævigata* and *I. verticillata,* the prettiest in fruit of the deciduous kinds, are sometimes sold for this purpose. The deciduous species are mostly shrubs, while many of the evergreen species grow into small or medium-sized trees, and *I. opaca* is the tallest of the broad-leaved evergreens which are hardy North and thrives even on extremely poor soil, and has good color also; the evergreens *I. crenata,* and *I. glabra* always remain shrubby. *I. Aquifolium* is a favorite evergreen in English gardens, and numerous varieties are there in cultivation; it also grows well on the Pacific coast from British Columbia to California. It stands severe pruning well, and can be clipped and trained into almost every shape; it also makes fine hedges, but its slow growth is a disadvantage. As the chief value of the deciduous species is in the ornamental fruits, and the hollies are dicœcious, care should be taken to choose in planting mostly pistillate plants and a few staminate ones and to give the former the most prominent place. The light, close-grained and tough wood of some of the arborescent species is much valued for turnery-work, engraving and cabinent-making. The leaves of some tropical species, as *I. paraguariensis* and *I. conocarpa,* yield a kind of tea known as Yerba de Maté, or Paraguay tea, which is much used in South America.

The hollies grow best in rich, well-drained soil, and the evergreen ones in partly shaded situations, but *I. lævigata, I. verticillata* and also *I. serrata* prefer moist places, and grow even in swamps. Most of the species grow slowly, and are not easily transplanted when older. The best time for moving the evergreen species is the early fall, when the young wood has almost ripened, or in the spring just before the plants start into new growth. The leaves should be stripped on *I. opaca* and *I. Aquifolium* when transplanted, particularly if at all exposed—or at least nearly all. This is absolutely necessary to insure success. Wild hollies may be handled this way with success, particularly if cut back as well. Propagation is by seeds, which do not germinate until the second year, and are therefore stratified and treated like those of the slow-growing hawthorns. The young seedlings should be transplanted after the second year. The evergreen species may be increased by cuttings of ripened wood under glass, especially the shrubby ones; they are also sometimes grafted or budded on seedlings of *I. Aquifolium* or *I. opaca.*

INDEX.

albo-marginata, 21.
albo-picta, 22.
alteclarensis, 2.
Amelanchier, 50.
angustifolia, 44.
Aquifolium, 1.
argentea, 21.
argenteo-marginata, 21.
argenteo-medio-picta, 22.
argutidens, 53.
aureo-maculata, 23.
aureo-marginata, 24.
aureo-regina, 24.
aureo-picta latifolia, 25.
aureo-variegata, 46.
bronzensis, 52.
camelliæfolia, 20.
caroliniana, 45.
Cassine, 44, 45.
chinensis, 8.
chrysocarpa, 52.
conspicua, 7.
cornuta, 36.
crenata, 46.
crispa, 19.
Dahoon, 44.
decidua, 48.
dipyrena, 38.
dubia, 49.
echinata, 14.
Fargesii, 42.
fastigiata, 52.
ferox, 14.
ferox argentea, 26.
ferox aurea, 27.
Fortunei, 46.
fructu aurantiaco, 32.
fructu luteo, 31.
glabra, 47.
handsworthensis, 9.
hastata, 10.
Herveyi, 51.
heterophylla, 15.
heterophylla aureo-picta, 28.
Hodginsonii, 3.
integra, 40.
lævigata, 51.
latifolia, 4, 41.
latifolia marginata, 24.
laurifolia, 16.
laurifolia longifolia, 20.
lineata, 11.
longifolia, 46.
luteo-variegata, 46.
macropoda, 49.
maderensis, 35.
magnifica, 20.
marginata, 17.
megalophylla, 42.
microphylla, 11, 46.
mollis, 49.
monticola, 49.
Mundyi, 7.
myrtifolia, 12, 44.
nobilis, 7.
opaca, 39.
Othera, 40.
paraguariensis, 43.
paraguensis, 43.
paucispinosa, 38.
pendula, 33.
perado, 35.
Pernyi, 37.
platyphylla, 35.
platyphyllos, 5.
princeps, 6.
pyramidalis, 34.
quercifolia, 39.
recurva, 19.
scotica, 18.
scotica aurea, 29.
serrata, 53.
serratifolia, 13.
Shepherdii, 7.
Sieboldii, 53.
tenuifolia, 52.
tortuosa, 19.
variegata, 35.
Veitchii, 37.
verticillata, 52.
vomitoria, 45.
Wateriana, 30.
Wilsonii, 7.
xanthocarpa, 39, 53.

A. *Foliage evergreen (Nos. 1–47).*

B. *Lvs. with coarse, spiny teeth, rarely entire.*

C. *Fls. in axillary clusters on branches of the previous year.*

D. *Frs. and fls. stalked.*

E. *Shape of lvs. oval or ovate to lanceolate.*

1. **Aquifòlium,** Linn. ENGLISH HOLLY. Fig. 1946. Tree, to 40 ft., with short, spreading branches, forming an oblong or pyramidal head, in cult. often shrubby, glabrous: lvs. short-petioled, usually ovate or oblong-ovate, waved and with strong, spiny teeth, shining, 1½–3 in. long: fr. scarlet, globular, shining. May, June. S. and Cent. Eu., W. Asia, China. Gng. 4:83. H.W. 3, p. 51.—A very variable species. A full account of the numerous varieties cult. in England is given by T. Moore in G.C. II. 2, pp. 432, 519, 687, 750, 812; 4, pp. 687, 741; 5, pp. 43, 365, 437, 624; 6, pp. 232, 389, 616, where 153 varieties are described and many of them figured. Some of the most important and most distinct are described below. *Osmanthus Aquifolium,* Sieb. & Zucc., an oleaceous shrub, which may readily be known by its opposite lvs., is occasionally supplied by dealers as a variety of *Ilex Aquifolium.*

1946. Ilex Aquifolium. (×⅓)

(a) *Varieties with foliage green.*

(b) *Lvs. spiny-toothed.*

(c) *Size of lvs. large, about 2–4 in. long.*

2. Var. **alteclarénsis,** Loud. Lvs. oval, large, thin and rather plain, with numerous teeth. G.C. III. 34:322. G.M. 54:321. 3. Var. **Hŏdginsonii,** Waterer. Lvs. roundish ovate, dark green, 2¾–3¼ in. long, with distant and nearly equal spines. G.C. III. 34:322. 4. Var. **latifòlia,** Loud. Lvs. oval, to 3½ in. long, with rather few, divaricate teeth. G.C. II. 2:433. 5. Var. **platyphýllos,** Goepp. Lvs. broadly ovate, to 3½ in. long, with divaricate spines, thick, deep green. 6. Var. **prínceps,** Moore. Lvs. broadly ovate, to 4½ in. long, with strong, regular spines, dark green, with prominent veins below. G.C. II. 13:45. 7. Var. **Wílsonii,** Hort. Lvs. oval, with numerous well-developed spines in the same plane, dark green, with distinct veins, up to 5 in. long: fr. large. G.C. III. 30:117. Gn. 69:205. In this group belong also, var. *conspícua,* Moore (G.C. II. 13:45); var. *Múndyi,* Hort. (Gn. 65, p. 394); var. *nóbilis,* Lawson (G.C. II. 2:432. Gn. 63, p. 423); var. *Shépherdii,* Waterer (Gn. 65, p. 394).—The varieties of this group are probably mostly hybrids between *I. Aquifolium* and *I. perado.* A geographical variety is 8, var. **chinénsis,** Loes. Lvs. ovate-oblong to oblong-lanceolate, spiny-dentate: fls. smaller. Cent. China.

(cc) *Size of lvs. small, 1–2 in. long.*

9. Var. **handsworthénsis,** Fisher. Lvs. ovate-lanceolate, with numerous, moderately divaricate spines, projected toward the apex, glossy green. G.C. II. 2:519; III. 30:118, 131. 10. Var. **hastàta,** Smith. Lvs. ovate-lanceolate, halbert-shaped; spines large, usually only 2–4 on each side at the base, the upper half usually entire. G.C. II. 2:687. 11. Var. **microphýlla,** Fisher. Lvs. ovate-lanceolate, about 1 in. long, shining green, with small, equal plane spines. G.C. II. 2:751. A very small-lvd. form, but var. **lineàta,** Waterer, is still smaller, and has the smallest lvs. of all. 12. Var. **myrtifòlia,** Waterer. Lvs. ovate-lanceolate, 1–1½ in. long, moderately spiny, rarely entire. G.C. II. 2:687. G.M. 31:652. 13. Var. **serratifòlia,** Loud. Lvs. ovate-lanceolate, stiff, with numerous small spiny teeth. G.C. II. 2:687. 14. Var. **fèrox,** Ait. (*I. echinàta,* Mill.). Lvs. of medium size, with strong teeth and numerous small spines on the upper convex surface. A very distinct variety, known as hedgehog holly.

(bb) *Lvs. all or most of them without spines.*

15. Var. **heterophýlla,** Ait. Lvs. oval or elliptic-ovate, about 2½ in. long, sometimes twisted near the apex, entire or with few spiny teeth. G.C. II. 2:519. 16. Var. **laurifòlia,** Loud. Lvs. ovate to elliptic-lanceolate, 2–3 in. long, usually quite entire. G.C. III. 34:314. Gn. 63, pp. 378, 423, 424. 17. Var. **marginàta,** Loud. Lvs. broadly ovate, sometimes twisted near the apex, with thickened entire margin. G.C. II. 2:813. 18. Var. **scótica,** Hort. Lvs. oval-obovate, blunt and rounded at the apex, rarely pointed, 1½–2 in. long, with thickened, wavy entire margin. G.C. II. 2:813. 19. Var. **recúrva,** Loud. (var. *crispa,* Lawson; var. *tortuòsa,* Waterer). Lvs. oval and spirally twisted, with revolute margin, entire or with few spines, about 2 in. long: of dense habit. G.M. 31:654; 36:764. G.C. II. 2:813. 20. Var. **camelliæfòlia,** Fisher (var. *magnífica,* Hort.; var. *laurifòlia longifòlia,* Hort.). Lvs. elliptic or oblong, acuminate, dark olive-green, very glossy, entire or with a few spines near the apex. G.C. II. 2:813. Gn. 65, p. 220. G.M. 31:783. Gt. 55:1551, 4.

(aa) *Varieties with foliage variegated.*

(b) *Lvs. spiny-toothed.*

21. Var. **álbo-marginàta,** Loud. (var. *argénteo-marginàta,* Hort.; var. *argéntea,* Hort.). Lvs. broadly ovate, to 2½ in. long, with numerous irregular spines, dark green, the disk mottled with grayish green, with rather narrow silvery margin. Gn. 64, p. 301. G.M. 48:84. 22. Var. **álbo-pícta,** Loud. (var. *argénteo-mèdio-pícta,* Hort.). Lvs. ovate, with divaricate spines, dark green, with a whitish center and a narrow, irregular, silvery margin. G.C. II. 4:687. 23. Var. **aùreo-maculàta,** Hort. Lvs. oblong-oval, 2½ in. long, with distant triangular, somewhat divaricate spines, with a large creamy-white blotch in the center, outer part of the margin dark green, inner part mottled pale gray. G.M. 31:654. 24. Var. **aùreo-regìna,** Hort. (var. *aùrea-marginàta* and var. *latifòlia marginàta,* Hort.). Lvs. broadly ovate, to 3 in. long, with strongly divaricate spines, mottled with gray and green, with a broad, continuous golden yellow margin. G.C. II. 5:44. G.M. 54:322. 25. Var. **aùreo-pícta latifòlia,** Hort. Lvs. ovate or broadly ovate, 2 in. or more long, with a large, branching, deep yellow blotch in the middle, and with an irregular, deep glossy green margin. G.C. II. 5:624. 26. Var. **fèrox argéntea,** Loud. Like var. *ferox,* but the margin and the surface spines creamy white. G.C. II. 5:44. 27. Var. **fèrox aùrea,** Loud., is like the former, but with yellow spines and margin. G. C. II. 6:616.

(bb) *Lvs. spineless or mostly so.*

28. Var. **heterophýlla aùreo-pícta,** Hort. Lvs. ovate, flat, sometimes with few spines, about 2½ in. long, marked in the middle with a broad feathery blotch of bright yellow. G.C. II. 6:389. 29. Var. **scótica aùrea,** Hort. Lvs. obovate, blunt, slightly wavy, about 1½ in. long, dark, mottled green, with a broad golden margin: of dwarf habit. 30. Var. **Waterìana,** Hort. Lvs. oblong or ovate, with a few spines, or entire and plain and obtuse, about 2 in. long, mottled with gray and yellowish green and edged with a broad, irregular golden band. G.C. II. 6:233.

1947. Ilex opaca. (×⅓)

There are also some other varieties in cultivation, as 31, var. **frùctu lùteo,** Lawson, with yellow, and 32, var. **frùctu aurantíaco,** Paul, with orange berries; 33, var. **péndula,** Waterer, with pendulous branches (Gn.

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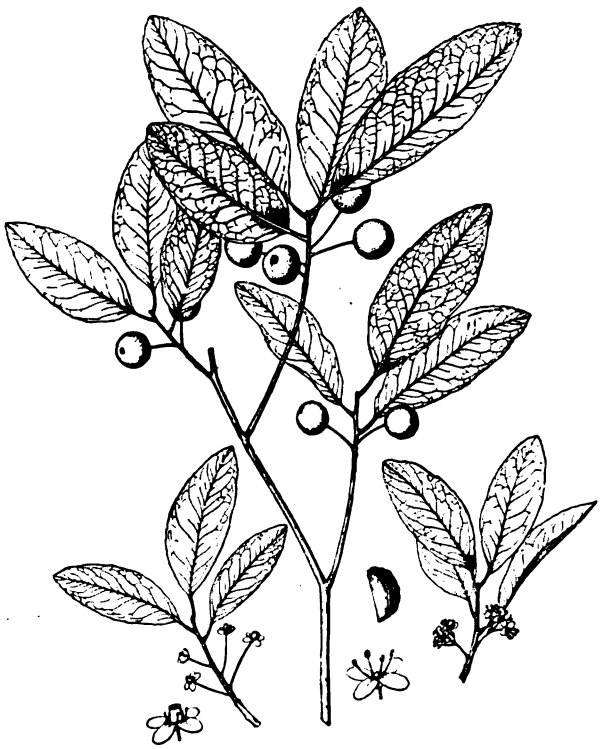
62, p. 129. G.M. 48:81); and 34, var. **pyramidàlis,** Hort., with ascending branches, forming a narrow, oblong head.

35. **peràdo,** Ait. (*I. maderénsis,* Lam.). Shrub or tree, to 20 ft.: lvs. ovate, obovate or oval to oblong-lanceolate, spiny-dentate, or dentate-serrate with short spines, sometimes entire, spiny-pointed, or sometimes obtuse or even emarginate, glossy above, reticulate below, 2–4 or sometimes to 6 in. long, the blade decurrent into the margined petiole deeply channelled above: fr. dark red or nearly black, ½in. across. Madera, Canary Isls., and Azores. L.B.C. 6:549. B.M. 4079. G.C. III. 34:317. Gn. 69:205. G. M. 48:150. Var. **platyphýlla,** Loes. (*I. platyphýlla,* Webb. & Berth.). Lvs. ovate, rarely oblong, 4–8 in. long. in the staminate plant smaller, entire or spiny dentate-



1948. Ilex Amelanchier (×½). No. 50.

serrate with irregular short teeth. Var. **variegàta,** Hort. (*I. maderénsis variegàta,* Hort.). Lvs. 2½–3 in. long, with rather evenly arranged spiny teeth, with a golden blotch mixed with pale green in the center.

EE. *Shape of lvs. quadrangular-oblong, 3-pointed at the apex.*

36. **cornùta,** Lindl. Shrubby, with short spreading branches, glabrous: lvs. quadrangular-oblong, with 3 strong spines of nearly equal size at the dilated apex, and with 1–2 strong spines on each side of the truncate base, but rounded and spineless at the base on older plants, dark glossy green above, 1½–3 in. long: fr. scarlet, clustered, short-pedicelled. June, July. N. China. G.C. 1850:311. F.S. 7, p. 216; 9:895. B.M. 5059. I.H. 1:10.

DD. *Frs. and fls. sessile or nearly so.*

37. **Pérnyi,** Franch. Shrub, to 10 ft.: branchlets densely and minutely pubescent: lvs. crowded, short-petioled, rhombic- or quadrangular-ovate, with 1–3 rigid spines on each side, the upper pair the largest, but shorter than the terminal spiny point, dark green and lustrous above, ¾–1 in. long: fls. in dense sessile clusters: fr. bright red, about ⅓in. across. May; fr. in Aug. Cent. China. H.I. 16:1539. G.C. III. 45:75. J.H.S. 34:220 (fig. 110). G.M. 51:714. R.B. 35:24. M.D.G. 1909:145.—A handsome evergreen of very compact habit. Var. **Veìtchii,** Rehd. (*I. Veìtchii,* Veitch). Lvs. truncate at the base, larger, 1½–2 in. long, with 4–5 rigid spines on each side.

38. **dipyrèna,** Wall. Tree, to 40 ft.: branchlets glabrous: lvs. short-petioled, elliptic-ovate to ovate-oblong, broadly cuneate or nearly rounded at the base, short and spiny-acuminate, remotely spiny-serrate with flat, not wavy margin, rarely entire, dark green and lustrous above, pale below, 2–4 in. long; petiole about ½in. long: fls. in axillary dense clusters, nearly sessile: fr. ovoid, red, lustrous, nearly ½in. long, with usually 2 stones. Himalayas. G.M. 54:339. Var. **paucispinòsa,** Loes. Lvs. oval to ovate-oblong, with 3–5 spreading strong spines on each side. Cent. China.

CC. *Fls. in 1- to few-fld. axillary, solitary cymes, on this year's growth.*

39. **opàca,** Ait. (*I. quercifòlia,* Meerb.). AMERICAN HOLLY. Fig. 1947. Tree, with spreading short branches, sometimes to 50 ft., forming a narrow, pyramidal head, glabrous: lvs. oval or elliptic-lanceolate, with large remote spiny teeth, rarely entire, dull green above, yellowish green beneath, 2–4 in. long: fr. dull scarlet, usually solitary, globose. June. Mass. to Fla., west to Mo. and Texas. Em. 385. S.S. 1:45. Gng. 4:276, 277. F.E. 16:444, pl. 63; 20:402, pl. 14. Gn.M. 2:19; 4:237. V. 3:86; 12:79, 80.—Hardier than *I. Aquifolium,* but less handsome. Var. **xanthocárpa,** Rehd. Frs. yellow.

BB. *Lvs. serrate, crenate or entire.*

C. *Fr. red or yellow; nutlet ribbed on the back. Tender.*

D. *Margin of lvs. entire.*

40. **íntegra,** Thunb. (*Othèra japónica,* Thunb. *Ilex Othèra,* Spreng.). Evergreen shrub or tree, to 40 ft., glabrous: lvs. slender-petioled, oval to elliptic-oblong or oblong-obovate, rarely oblanceolate, narrowed at the base, at the apex contracted into a short obtuse point, entire, very rarely with a few teeth, indistinctly veined, 2–3½ in. long; petiole ⅓–¾in. long: fls. on stalks ⅛–⅓in. long, in axillary fascicles on branches of the previous year: fr. red, globose or ovoid, ⅓–½in. long. Feb.–April; fr. in Aug.–Oct. Japan. S.I.F. 1:60. —Variable in the size and shape of the lvs. and in the length of the pedicels; one of the forms is cult. in the S. as *Othera japonica.*

DD. *Margin of lvs. crenate or serrate.*

E. *Lvs. longer than 3 in.*

F. *Apex of lvs. acuminate or acute.*

41. **latifòlia,** Thunb. Tree, sometimes to 60 ft., glabrous: lvs. oval to oblong-lanceolate or obovate-oblong, acuminate, serrate, glossy green above, 3–7 in. long; petiole about ½in. long: fr. red, ⅓in. across, short-stalked, in dense clusters. June. Japan. B.M. 5597. S.I.F. 1:62.—One of the most beautiful hollies.

42. **Fárgesii,** Franch. Shrub, to 15 ft., glabrous: lvs. oblong-lanceolate to oblanceolate, narrowly cuneate at the base, long-acuminate, denticulate-serrate usually only above the middle, dull green above, 3–5 in. long; petiole slender, about ½in. long: fls. short-stalked in dense axillary clusters on branchlets of the previous year: berries red, ¼–⅓in. across, on stalks about ¼in. long. May, June: fr. in Sept. Cent. China. Var. **megalophýlla,** Loes. Lvs. to 6 in. long and 1½ in. broad.

FF. *Apex of lvs. obtuse.*

43. **paraguariénsis,** St. Hil. (*I. paraguénsis,* Don). Shrub or small tree, to 20 ft.: branchlets glabrous or puberulous: lvs. obovate to obovate-oblong

or elliptic-oblong, narrowed at the base, obtuse or short and obtusely acuminate, crenate-serrate, glabrous or pubescent below, 3–5, rarely to 10 in. long: fls. axillary, fascicled or in stalked cymes: fr. globose or ovoid, ⅛–¼in. across, red or reddish brown. Brazil. B.M. 3992. J.F. 3, p. 69.

EE. *Lvs. shorter than 3 in.*

44. **Cassìne,** Linn. (*I. Dahoòn,* Walt.). DAHOON. Shrub or small tree, to 30 ft.: lvs. obovate to oblong-linear, acute or obtuse and mucronulate, entire or sharply serrate above the middle, usually pubescent

1949. Ilex lævigata (×½). No. 51.

beneath when young, 2–3 in. long: fr. globose, small, dull red, rarely yellow, on this year's growth. April, May. N. C. to Fla., west to La. S.S. 1:46. Var. **angustifòlia,** Ait. Lvs. linear-oblong to linear, 2–3 in. long. Var. **myrtifòlia,** Chapm. Lvs. linear-oblong, 1–2 in. long: fr. usually solitary. S.S. 1:45.—Cassine or cassena is the name in the language of the Timucua Indians for an exhilarating beverage prepared from the lvs. of the following plant which had been confused with this species; the name seems to have been borrowed from the Muscogee word *ássi,* leaves, modified by a prefix.

45. **vomitòria,** Ait. (*I. Cassìne,* Walt., not Linn. *I. caroliniàna,* Loes.). CASSENA. YAUPON. Shrub, rarely tree, to 25 ft., with spreading branches: lvs. oval or oblong, obtuse, crenate, glabrous, ½–1, rarely to 2 in. long: fls. clustered on branches of the previous year: fr. scarlet, globose, small. April. Va. to Fla., west to Ark. and Texas. S.S. 1:48. C.L.A. 13:498.

CC. *Fr. black; nutlets smooth: pistillate fls. usually solitary, on this year's growth.*

46. **crenàta,** Thunb. (*I. Fórtunei,* Hort.). Much-branched shrub, rarely small tree to 20 ft.: lvs. oval, obovate or oblong-lanceolate, crenately serrate, glabrous, ½–1½ in. long: fls. 4-merous: fr. ¼in. across, solitary, short-stalked. May, June; fr. in Oct. Japan. Gng. 6:165. F.E. 30:1161. G.M. 46:208. Gn. 64, p. 413. Gn.M. 4:237. Var. **microphýlla,** Maxim. Lvs. ⅓–½in. long, elliptic or elliptic-oblong. This variety is somewhat hardier than the type. Var. **longifòlia,** Hort. Lvs. elliptic-oblong to lanceolate. Var. **lùteo-variegàta,** Regel (var. *aùreo-variegàta,* Hort.). Lvs. spotted yellow, obovate. M.D.G. 1913:53.

47. **glàbra,** Gray (*Prìnos glàber,* Linn.). INKBERRY. WINTERBERRY. Much-branched upright shrub, to 8 ft.: lvs. obovate to oblanceolate, obtuse, with few obtuse teeth toward the apex, glabrous, 1–2 in. long: fls. 5–8-merous. June. Mass. to Fla., west to Miss. L.B.C. 5:450.

AA. *Foliage deciduous: fr. red.* (*Prinos.*)

B. *Frs. mostly and lvs. partly fascicled on short spurs: nutlets ribbed on the back.*

48. **decídua,** Walt. (*Prìnos decìduus,* DC.). Shrub or small tree, to 30 ft., with light gray, spreading branches: lvs. cuneate-oblong or obovate, usually obtuse, crenately serrate, dark green, and with impressed veins above, pale and pubescent beneath, 1½–3 in. long: fr. globose, orange or orange-scarlet, ⅓in. across. May. Va. to Fla., west to Texas. S.S. 1:49. G.C. II. 14:689.

49. **monticola,** Gray (*I. dùbia,* Brit. Stern. & Pogg.). Tree, to 40 ft., with slender branches, forming a narrow pyramidal head or spreading shrub: lvs. oval or oval-lanceolate, acute or acuminate, sharply serrate, pubescent only along the veins beneath, 2–6 in. long: fr. red, globular-ovoid, over ⅓ in. across. May. N. Y. to S. C., west to Ala. S.S. 1:50. Var. **móllis,** Brit. (*I. móllis,* Gray). Lvs. broadly ovate, soft-pubescent when young, glabrous above at length. Var. **macrópoda,** Rehd. (*I. dùbia* var. *macrópoda,* Loes. *I. macrópoda,* Miq.). Lvs. ovate or oval, pubescent below. Japan, Cent. China. S.I.F. 1:59.

BB. *Frs. and lvs. not fascicled: frs. axillary.*

C. *Stalks of fr. ⅓in. long, nutlets ribbed on back.*

50. **Amelánchier,** Curtis. Fig. 1948. Deciduous shrub to 6 ft.: lvs. oblong, subacute, serrate, pubescent, 1½–3 in. long: staminate fls. several on a common peduncle: fr. dull red, large; nutlets strongly 3-ribbed on back. Va. to La. G.F. 2:41 (adapted in Fig. 1948).—Hardy.

CC. *Stalks of fr. ¼in. or shorter; nutlets smooth.*

D. *Fls. 6–9-merous.*

51. **lævigàta,** Gray (*Prìnos lævigàtus,* Pursh). WINTERBERRY. Fig. 1949. Low shrub, of upright habit: lvs. lanceolate, acute, finely or crenately serrate, rather thick, glabrous or nearly so, 1½–2½ in. long, turning clear yellow in fall: staminate fls. on long and slender stalks: fr. depressed-globose, bright orange-red, over ¼in. across. May, June; fr. in Sept. Maine to Pa. and Va. G.F. 4:221 (adapted in Fig. 1949). Gt. 55:1551, 3. Var. **Hérveyi,** Rob. Frs. bright yellow.

52. **verticillàta,** Gray (*Prìnos verticillàtus,* Linn.). BLACK ALDER. WINTERBERRY. Fig. 1950. Shrub, with spreading branches: lvs. obovate to oblanceolate or lanceolate, acuminate or acute, serrate or doubly serrate, usually pubescent beneath, 1½–3 in. long, turning black after frost: all fls. short-stalked: fr. bright red, about ¼in. across. June, July: fr. in Oct. Canada to Fla., west to Wis. and Mo. Em. 388. F.E. 24: 779. Var. **tenuifòlia,** Torr. (*I. bronxénsis,* Brit.). Lvs. obovate, glabrous or pubescent, thin: fls. and frs. larger. B.B. (ed. 2) 3:489. Var. **chrysocàrpa,** Rob. Frs. bright yellow. Also *I. fastigiàta,* Bicknell, from Nantucket, differing in its fastigiate habit and in the narrower lanceolate or oblong-lanceolate lvs., is probably only a variety of this species.—Very variable in shape and texture of lvs. One of the best hardy shrubs with ornamental frs. remaining on the branches until midwinter, and are rarely eaten by birds.

DD. *Fls. 4–5-merous.*

53. **serràta,** Thunb. (*I. Sieböldii,* Miq.). Slender shrub, to 15 ft., similar to the former but smaller in every part: lvs. elliptic or ovate, acute or acuminate, finely serrate, pubescent beneath, 1–2 in. long: fls. 4–5-merous: fr. bright red, small ⅙–⅕in. across. June;

fr. in Oct. Japan. S.T.S. 1:15. S.I.F. 1:61. Var. **argûtidens,** Rehd. (*I. argùtidens*, Miq.). Lvs. glabrous beneath, short-petioled, teeth more remote and less fine: fls. usually 4-merous. Var. **xanthocárpa,** Hort. Frs. yellow.

I. ambígua, Chapm. Deciduous large shrub, allied to I. monticola. Lvs. usually almost glabrous, remotely serrate, 1–2 in. long. N. C. to Fla., west to Ark. and Texas.—*I. Brandegeeàna*, Loes. Evergreen tree to 40 ft.: branchlets pubescent: lvs. elliptic-lanceolate, remotely serrate or almost entire, pubescent, 2–3½ in. long: fls. 5-merous. Low. Calif. G.F. 7:416 (by error named I. californica.)—*I. califórnica*, Brandegee. Evergreen large shrub, to 12 ft., glabrous: lvs. elliptic to oblong-elliptic, obtuse, remotely and crenately serrulate, 2–5 in. long: fr. black, small. Low. Calif. G.F. 7:415 (by error named I. triflora).—*I. canariénsis*, Poir. Evergreen tree, to 20 ft., glabrous: lvs. ovate to ovate-oblong, obtuse, entire, 2–4 in. long: fr. usually solitary, on this year's growth. Canaries.—*I. conocárpa*, Reiss. Evergreen shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, serrulate, glabrous, 3–5 in. long: fls. in short, dense spikes: fr. ovoid-conic. Brazil. B.M. 7310.—*I. cordìlina*, Franch. Evergreen shrub: lvs. ovate-oblong, acuminate, spiny-serrate or nearly crenate-serrate, 2–3 in. long: frs. small, red, nearly sessile, in dense clusters. W. China.—*I. coriàcea*, Chapm. (I. lucida, Torr. & Gray). Allied to I. glabra, but taller: lvs. broader and longer, to 3 in., acute or acuminate. N. C. to Fla., west to La.—*I. Franchetiàna*, Loes. Evergreen shrub, to 12 ft., glabrous: lvs. elliptic-obovate to lanceolate-oblong or oblanceolate, acuminate, denticulate, 2½–4 in. long: fr. bright red on short stalks, in dense clusters. W. China. —*I. geniculàta*, Maxim. Deciduous shrub, glabrous: lvs. ovate to elliptic-ovate, acuminate, sharply serrate, 1½–2 in. long: fr. scarlet, solitary, drooping on filiform peduncles ¾–1½ in. long. Japan. Very graceful shrub; has proved hardy at the Arnold Arboretum.—*I. gongónha*, Mart.=Villaresia mucronata. —*I. insígnis*, Hook. f. Evergreen small tree: lvs. elliptic-lanceolate, 6–9 in. long, spiny-toothed, often almost entire on older plants: fr. large, globose. Himalayas. G. C. II. 14:297. G. M. 31:475.—*I. lóngipes*, Chapm. Deciduous shrub, allied to I. decidua: lvs. elliptic-lanceolate, crenately serrate, almost glabrous: fr. globose, slender-pedicelled. N. C. to Ga., west to La. G. F. 3:345.—*I. macrocárpa*, Oliver. Deciduous tree, to 30 ft., glabrous: lvs. elliptic or elliptic-ovate to oblong-lanceolate, finely serrate, 3–4½ in. long: frs. black, solitary, ½–¾in. across, on peduncles ½–1¼ in. long. Cent. China. H. I. 18:1787.—*I. microcárpa*, Lindl.=I. rotunda, Thunb.—*I. Oldhamii*, Miq.=I. purpurea, Thunb.—*I. pedunculòsa*, Miq. Evergreen small tree, glabrous: lvs. slender-petioled, elliptic-ovate to ovate-oblong, abruptly short-acuminate, entire or sparingly serrulate, 1½–3 in. long: fr. red, usually solitary on slender pedicels 1½–2 in. long. Japan. S. I. F. 1:61. Var. *continentàlis*, Loes. Lvs. generally larger, thicker: sepals ciliate. Cent. China.—*I. purpùrea*, Thunb. (I. Oldhamii, Miq.). Evergreen tree, glabrous: lvs. elliptic-ovate to oblong-lanceolate, crenate-serrulate, 2–3 in. long.: fr. red, ½in. across, pedicelled, usually 2–5 on a common peduncle about ½in. long. Japan, Cent. China. S. I. F. 1:62.—*I. rotùnda*, Thunb. (I. microcarpa, Lindl.). Evergreen shrub or tree, to 40 ft.: lvs. oblong or elliptic, acute, pointed, quite entire: fr. small, red, in peduncled clusters. Japan. G. C. 1850:311. F.S. 7, p. 216. S. I. F. 1:60.—*I. rugòsa*, F. Schmidt. Evergreen low spreading shrub, sometimes prostrate, glabrous: lvs. oblong-lanceolate to lanceolate, remotely crenate-serrate, rugose above, ¾–2 in. long: fr. usually solitary, scarlet. Japan, Saghalin. —*I. szechwanénsis*, Loes. Evergreen shrub, to 12 ft., glabrous: lvs. short-petioled, ovate- to elliptic-oblong, serrulate, 1–2½ in. long.: fr. black, solitary, on stalks about ¼in. long. Cent. China.—*I. triflòra*, Brandegee=I. Brandegeeana. —*I. yunnanénsis*, Franch. Evergreen shrub, to 10 ft.: branchlets villous: lvs. short-stalked, ovate to ovate-oblong, crenate-serrate or serrulate, pubescent below, at least on the midrib, ¾–1½ in. long: fr. red, solitary, stalked. W. China.

ALFRED REHDER.

ILLÍCIUM (Latin for *allurement;* probably in reference to the agreeable odor). *Magnoliàceæ*. Small trees or shrubs, one of which is sometimes planted far South.

Aromatic glabrous plants, with thick short-petioled entire evergreen lvs.: fls. perfect, small, solitary or in 3's in the axils of lvs. or bud-scales, nodding or inclined, yellow or purplish; sepals 3–6; petals many, imbricated in 3 or more rows or series; stamens 10 to many, with thick filaments: carpels usually many, forming a ring of almost woody pods.—Species about a score, mostly oriental (India, China, Philippines), and 2 in the S. U. S.

One of the illiciums furnishes the star or Chinese anise, which is the small star-shaped cluster of fruits. The odor and flavor strongly resemble anise. It is much used in oriental countries in cookery, and is exported to some extent and is said to be used in flavoring certain French wines. This product comes from China. It has been supposed to be the product of *I. anisatum* of Linnæus, but that plant is a Japanese tree and it contains a poison. In the American trade are the names *I. anisatum* and *I. religiosum*. It now transpires that these names belong to the same plant, and that the star anise is produced by another species. This other species, or the true star anise, was first accurately described and figured (as *I. verum*, Hook. f.) in B.M. 7005 (1888), where the confusion of two or three centuries is elucidated. There is probably only one east Asian illicium in the trade in North America, as follows:

anisàtum, Linn. (*I. religiòsum*, Sieb. & Zucc.). Small tree: lvs. alternate, elliptic, short-petioled, somewhat acuminate: fls. mostly solitary, sessile or nearly so, yellowish, not fragrant, with many very narrow petals, and 20–30 stamens. Japan. B.M. 3965.—Grown far S. About as hardy as camellia. There is a form with variegated lvs.

1950. Ilex verticillata (×½). No. 52.

Two native illiciums growing in the S. are: *I. floridànum*, Ellis. Shrub, 6–10 ft.: lvs. oblong-lanceolate, 4-in. or more long: petals 20–30, very narrow, dark crimson or purple. Fla. to La. B.M. 439. Gn. 36, p. 151. J.H. III. 30:365; 52:168. H.U. 5, p. 136.—*I. parviflòrum*, Michx. Lvs. elliptic or lanceolate, mostly under 4 in. long: petals very small (¼in. long), 6–12, yellowish: less tall. Ga. and Fla.—A species appearing in European horticultural literature in recent years is *I. laurifòlium*, Hort. It is described as a handsome evergreen shrub: lvs. short-stalked, oval, acute: fls. yellowish white, in many-fld. terminal cymes. Of uncertain origin. R.H. 1901, p. 17.—*I. vèrum*, Hook, f. The true star anise: 9 ft.: lvs. elliptic to oblanceolate: fls. red, globose, the petals about 10. China.

L. H. B.

IMANTOPHŸLLUM: *Clivia.*

IMBRICÀRIA: *Mimusops.*

IMMORTELLES: *Everlastings.*

IMPÀTIENS (from the Latin; having reference to the pods, which, when ripe, on slight pressure burst open, scattering the seed). *Balsamìnàceæ*. TOUCH-ME-NOT. Flower-garden and greenhouse subjects, grown for the odd and ornamental blossoms.

Tender, succulent annual or perennial herbs, often with very fleshy sts. and simple lvs. usually alternate (sometimes opposite) and the upper ones often in whorls: peduncles axillary, with 1–6 or more very irregular fls. of various colors; sepals 3 (seldom 5),

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the posterior one taking on a spur-like shape, the 2 lateral ones short, green; petals 2 or 3, the one at the back commonly very broad and erect, sometimes keeled or winged, the lateral ones more or less 2-lobed or auricled; stamens 5, the filaments appendaged and the scales connivent over the stigma: fr. a 5-valved pod, which, when ripe, bursts when pinched, scattering the seeds.—Species probably 500, widely distributed about the world, largely in mountainous regions in warm-temperate and tropical countries. The genus has been greatly enlarged in recent years, with explorations in Afr. and other regions. It abounds in species that will probably have horticultural value, although relatively few are now in cult. outside botanical collections. The garden balsam (*I. Balsamina*) is a general favorite in the annual flower-garden. *I. Sultani* is common in greenhouses, and latterly *I. Holstii*, *I. Oliveri*, and a few others are sometimes seen. This beautiful genus has not been much developed horticulturally. Great numbers of species, hybrids and interesting forms may be expected to appear in cult. in the future. The genus has immense possibilities for productive horticultural work. The common touch-me-not of Great Britain and other parts of Eu. is *I. Noli-tangere* (sometimes written *I. Noli-me-tangere*), an erect smooth branching annual, 2 ft. or less high, with large showy yellow fls. spotted with orange, on slender axillary peduncles. It has been reported as an escape in N. Amer. The N. American *I. biflora* is naturalized in England.

The cultivation of impatiens is mostly simple and easy. The seeds are large and germinate readily (see *Balsam*). The indoor species grow well and readily from either cuttings or seeds. Some of them also do well when grown as tender annuals in the open ground, although likely to suffer in dry weather and to bleach in bright sun. The remarks under *I. Oliveri*, *I. Sultani*, *I. Holstii*, *I. Hawkeri*, *I. platypetala*, *I. flaccida*, and *I. Hookeriana* indicate the treatment for the greenhouse kinds.

1951. Impatiens pallida.—One of the native jewel-weeds. (×½)

INDEX.

alba, 12, 13.
arcuata, 3.
aurea, 2.
Balfourii, 15.
Balsamina, 3.
biflora, 1.
biglandulosa, 13.
candida, 14.
coccinea, 3.
Episcopi, 7.
flaccida, 12.
fulva, 1.
glanduligera, 14.
grandiflora, 5.
Hawkeri, 10.
Holstii, 8.
Hookeriana, 13.
hortensis, 3.
latifolia, 12.
Liegnitzia, 8.
macran ha, 3.
macrochila, 14.
micrantha, 3.
moschata, 14.
Nortonii, 1.
Oliveri, 6.
oppositifolia, 4.
pallida, 2.
Petersiana, 9.
platypetala, 11.
pulcherrima, 11.
rosea, 3.
Roylei, 14.
Sultani, 7.
vulgaris, 3.

A. *Species of the U. S. and Canada, seldom grown in wild gardens, and frequently found about the borders of damp cult. grounds.*

1. **biflòra,** Walt. (*I. fúlva*, Nutt.). SPOTTED TOUCH-ME-NOT. JEWEL-WEED. Annual, with orange-colored fls. much spotted with reddish brown: spur strongly inflexed, about half as long as posterior sepal: lvs. ovate or oval, petioled and coarsely toothed: usually 2–3 ft. Moist, shady places. July–Oct. Nova Scotia to Alaska, Ore., Mo. and Fla.—Has been offered by dealers in native plants. **I. Nórtonii,** Rydb., of W. Mo. and Kans., differs from *I. biflora* in having larger and relatively longer and narrower saccate sepal which tapers gradually into a shorter spur.

2. **pállida,** Nutt. (*I. aùrea*, S. Wats.). PALE TOUCH-ME-NOT. JEWEL-WEED. Fig. 1951. With *I. biflora* the representatives of the family in the indigenous flora of the U. S. Larger than *I. biflora;* otherwise similar to it, with pale yellow fls. sparingly dotted with brownish red; spur short, notched, and less than one-third the length of the posterior sepal. Moist, shady places. July–Sept. Que. to Ore., Kans. and Ga.—Annual. Perhaps procurable from dealers in native plants.

AA. *Species of familiar flower-gardens: annuals.*

3. **Balsámina,** Linn. GARDEN BALSAM. Figs. 450–453, Vol. I. Annual, erect and branching, pubescent or nearly glabrous: lvs. either narrowly or broadly lanceolate and acuminate, deeply serrate, the petiole glandular: fls. large, rose-colored; standard orbicular and retuse; wings or side petals very broad, with the lateral lobe rounded and the terminal sessile and large; lip small and cone-like; spur variable, incurved: caps. large, tomentose. Trop. and Subtrop. India, Malaya, China.—Very variable in its wide range. Hooker recognizes 6 wild botanical varieties: Var. *vulgàris*, Hook. f. (*Balsámina hortènsis*, DC.). Tall: lvs. broadly lanceolate: fls. large, with short spur. Var. *coccínea*, Hook. f. (*Balsámina coccínea*, DC.). Lvs. narrow-lanceolate: fls. of medium size, the spur long and slender. B.M. 1256. Var. *arcuàta*, Hook. f. Diffusely branched: lvs. small and narrow: fls. small, the spur long, slender and arcuate. Var. *macrántha*, Hook. f. Four inches high: lvs. ovate-lanceolate: fls. large, with short spur. Var. *micrántha*, Hook. f. Small, simple: lvs. small, ovate-lanceolate: fls. small, with long and slender spur. Var. *ròsea*, Hook. f. (*I. ròsea*, Lindl.). Tall: lvs. linear-lanceolate: fls. rather small, with lip saccate and spur short and incurved. B.R. 27:27.—*I. Balsamina* now runs into many forms, through long cult. and breeding. See *Balsam*.

AAA. *Species of many countries, mostly of indoor cult., but sometimes grown in the open.*

B. *Lvs. linear: annual.*

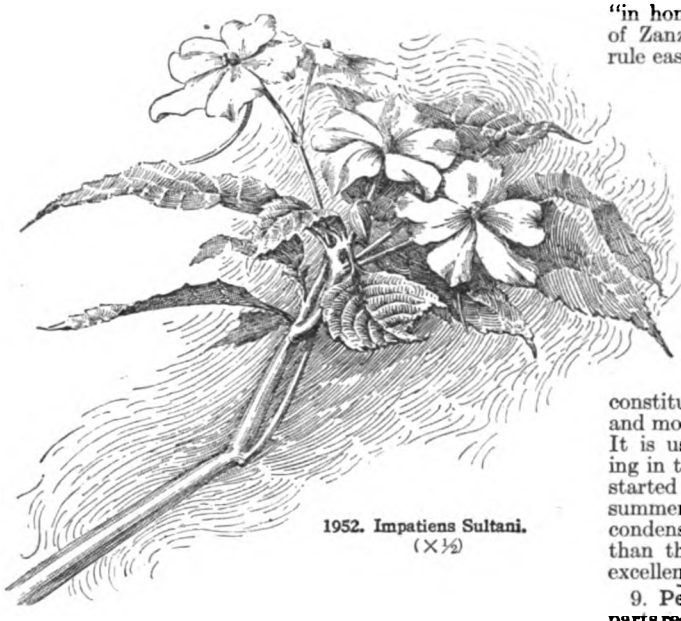
4. **oppositifòlia,** Linn. Annual of free-branching habit, very floriferous, erect: lvs. long-narrow-linear, mostly nearly sessile, remotely serrate: fls. about 1 in. diam., rosy red, purplish or pink, on glabrous pedicels; sepals linear, acuminate; wings with broad-obovate terminal lobe and small lateral lobe; lip conical, produced into a short and stout incurved spur. India. G.C. III. 42:102. G.M. 51:321.

BB. *Lvs. ovate to lanceolate: probably all perennial.*

C. *Peduncles axillary, 1-fld. or sometimes 2-fld.*

D. *Spur of fl. much enlarged or swollen at base.*

5. **grandiflòra,** Hemsl. Stout, branching, glabrous: lvs. alternate, stalked, 3–6 in. long, ovate-lanceolate and sinuate-crenate, puckered or blistered above between the nerves, glandular on lower part of blade and on petiole: fls. solitary, to 3 in. across, bright rose-red with crimson stripes on the wing-lobes; sepals 2, green, orbicular-ovate; standard orbicular, erect, short-spurred below the tip; lip 1¾ in. long, swollen, white netted with purple, abruptly narrowed into an incurved spur 1 in. or more long; wings very large, the terminal lobe obovate and the basal orbicular. Madagascar. B.M. 7826. G.C. III. 29:111.



1952. Impatiens Sultani. (×½)

6. **Óliveri,** Wright. Glabrous, reaching 4–8 ft., erect, the sts. pale green: lvs. 4–8 at a node, oblanceolate, acute or acuminate, to 8 in. long, dentate-ciliate: fls. 2¼ in. across, pale lilac or rose-colored, almost white beneath, on 1-fld. peduncles about 2½ in. long; lateral sepals ovate and acuminate, much shorter than the petals; lip ovate, funnel-shaped, with abrupt reflexed mucro; spur 1¾ in. long, curved, slender; standard nearly orbicular, recurved and apiculate at apex; wings deeply 2-lobed, the terminal lobe obovate and the lateral obcordate: fr. oblong. Trop. E. Afr., 6,000–8,000 ft. altitude. B.M. 7960. G.C. III. 40:292. Gn. 66, p. 266. G. 27:288, 405. G.W. 11, p. 1. R.H. 1908:180. A.F. 29:155. Gng. 16:3.—An excellent greenhouse subject and also useful in the open border. It makes a very showy plant when given cool greenhouse treatment, producing a bush 10 ft. through. Prop. readily either by seeds or cuttings, the former being produced freely.

DD. *Spur very slender throughout.*

7. **Sultáni,** Hook. f. Fig. 1952. From 12–24 in. high, with stout st. and branches, rather succulent and green, glabrous: lvs. elliptical or lanceolate and narrowed into a petiole about 1 in. long; lower lvs. alternate, upper ones almost whorled: peduncles axillary; fls. rich scarlet in the original form; petals flat; standard obovate-orbicular and retuse; lip less than half length of petals, suddenly narrowed into a slender upwardly curved long spur. Hybrids and sports have given shades from pink to almost purple, and a white variety also exists. Spur is very long and thin. Zanzibar. B.M. 6643. Gn. 23, p. 331. G. 14:283. V. 7:325, 326. S.H. 2:280. I.H. 30:488; 42, p. 140. R.H. 1884:12.—Increased by seeds; also by cuttings, which root readily. A greenhouse plant; it also does well as a house plant, blooming almost continuously. Var. **Episcopi,** Hort. A perpetual flowering variety with purple-carmine fls. marked brilliant rose.—*I. Sultani* was named by Hooker "in honor of that distinguished potentate, the Sultan of Zanzibar, to whose enlightened and philanthropic rule eastern Africa owes so much." See No. 13.

8. **Hòlstii,** Engler & Warb. Very like *I. Sultani*. Fleshy herb or subshrub, nearly glabrous, 2–3 ft.: the branches striped red: lvs. alternate, long-petioled, oval or ovate to lanceolate, acute, crenate and with a bristle between the teeth: fls. 1 or sometimes 2 on the peduncle, pure scarlet, 1¾ in. across, flat; sepals 3, the lateral small and scale-like; spur slender, 1½ in. long; standard broadly obcordate; lateral petals deeply divided into 2 obovate-spatulate lobes. E. Trop. Afr., 2,500–5,000 ft. B.M. 8029. G.C. III. 38:14. Gn. 72, p. 337; 74, p. 17. G.M. 48:413; 56:46. J.H. III. 51:65. R.H. 1906:136. G.W. 15, p. 356 (as var. *nana amabilis*).—Of better constitution under cult. than *I. Sultani*, having quicker and more vigorous growth, and larger and brighter fls. It is useful either as a pot-plant indoors or for growing in the open; for the latter purpose, seeds may be started early in spring and plants will bloom from early summer till frost. Var. **Liegnítzia,** Grign., is a compact condensed form, with color more clear and brilliant than the type, blooming freely throughout the year; excellent for pot cult. R.H. 1909, p. 279.

9. **Petersiàna,** Rehd. Very like *I. Holstii*, but all the parts red or bronzy rather than green, sts. pubescent, petioles longer: lvs. longer and elliptic rather than oval, peduncles and pedicels longer, fls. carmine-red rather than scarlet and the petals entire, caps. small and purple. W. Trop. Afr. M.D.G. 1905:390 (descr.) R.H. 1910:452.

1953. Impatiens flaccida. (×⅛)

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10. **Hâwkeri,** Bull. A bushy, soft-wooded plant, 2 ft. or less high, with well-branched sts. of a dull red color; lvs. opposite or in whorls of 3, ovate, acuminate, serrate, dark green, pale beneath: peduncles axillary, long and slender; fls. rounded in outline, about 3 in. diam., deep carmine, with a white eye; standard round-obovate, retuse; spur to nearly 3 in. long, slender and slightly curved. South Sea Isls. Intro. about 1886. B.M. 8247. G.C. II. 25:761. I.H. 34:2. Gn.W. 5:213. G.W. 14, p. 126. G.Z. 31, p. 122.—A greenhouse plant, needing an intermediate temperature. Plants from early spring cuttings bloom all summer and into autumn.

11. **platypétala,** Lindl. (*I. pulchérrima,* Dalzell). Sts. strong, succulent, branched and usually reddish purple: lvs. whorled, lanceolate or oval, serrate, hairy beneath: peduncles axillary, shorter than the lvs.; fls. large, rose-colored; spur sickle-shaped, rather thin and petals transversely obcordate. Summer. Java. R.H. 1847:221. B.R. 32:68.—Needs a moderate to warm temperature and may be used as a house-plant or in protected and warm situations outdoors. Prop. by cuttings, and during growth should be treated like gloxinias. Var. Lucie or Lucy belongs here.

12. **flâccida,** Arn. (*I. latifòlia,* Hook., not Linn.). Fig. 1953. Slender but erect, somewhat branched, glabrous, 6–18 in.: lvs. stalked, ovate or lanceolate, crenate, 2–5 in. long, the petiole with or without glands: fls. rose-purple, 1½ in. or less in diam., mostly solitary; sepals ovate; standard broad, 2-lobed, spurred; wings broad, 2-lobed, variable; lip boat-shaped, with a long slender curved spur about 1½ in. long and sometimes parted to the middle: caps. glabrous, ½in. long. India. B.M. 5276, 5625.—Thrives under the treatment given *I. Sultani.* There is a white-fld. form (var. *álba*).

cc. *Peduncles with 3–6 or more fls., often more or less clustered or terminal.*

13. **Hookeriàna,** Arn. (*I. biglandulòsa,* Moon. *I. Sultáni álba,* Hort.). A very succulent much-branched plant, growing to a height of 3 ft.: lvs. long-petioled, ovate-lanceolate, toothed: peduncles axillary in the upper lvs.; fls. large, white, spotted with purple on the large lower petals; spur bent horn-shaped, and longer than the fls. Blooms in fall. Ceylon. B.M. 4704. J.F. 14:391.—It is a perennial, requires a moderate temperature and does not bloom until well developed. Prop. by cuttings. One of the best species in cult.

14. **Róylei,** Walp. (*I. glandulígera,* Royle). Fig. 1954. A rather coarse garden annual, with strong st., succulent and much-branched: lower lvs. opposite; upper lvs. usually in 3's and whorled, all ovate or ovate-lanceolate, naked, 4 in. long, sharply serrate; basal serrations and the petiole glandular: peduncles axillary, with 3 or more fls. and very numerous toward top of plant; fls. large, dark purple; spur very short. Aug., Sept. India, in the Temp. W. Himalaya region, 6,000–8,000 ft. altitude. B.M. 4020. B.R. 26:22. J.F. 4:427.—Grown from seed, needing but little care, and useful in groups. In its native country it grows 4–10 ft. high. Variable. Var. *moschàta,* Hook. (*I. moschàta,* Edgew.), has lvs. alternate and whorled, coarsely serrate and less glandular. Var. *cándida,* Hook. (*I. cándida,* Lindl.), has uppermost lvs. opposite or whorled, and fls. white spotted crimson. J.F. 4:416. Var. *macrochìla,* Hook. (*I. macrochìla,* Lindl.), has upper lvs. alternate; terminal lobes of the wings half-oval (as if one side wanting) and falcate. B.R. 26:8.

15. **Bâlfourii,** Hook. f. Glabrous, slenderly branching, 2–3 ft.: lvs. 3–5 in. long, short-stalked, ovate-lanceolate and very long-acuminate, with many minute recurved teeth, glandless: fls. loosely racemose at the top of the st. on very slender pedicels, large, rose and yellow; sepals 2, nearly orbicular, small; standard orbicular, reflexed, white suffused rose; the keel red; wings 1¼ in. long, pale yellow on basal lobe and bright rose on the hatchet-shaped terminal lobe; lip to 1¼ in. long, gradually narrowed into a horn-like somewhat incurved obtuse spur: caps. erect, narrow, to 1½ in. long, red on the angles. W. Himalayas. B.M. 7878.

I. auricoma, Baill. Perennial, 6–24 in.: lvs. alternate, lanceolate, acuminate, crenate and with bristles: fls. golden yellow streaked red within; lateral petals connate; spur short, curved, 2-parted: sts. and midrib reddish. Comoro Isls., Mozambique. B.M. 7381.—*I. chrysántha,* Hook. f. Annual, glabrous: lvs. alternate, lance-ovate, serrate: fls. several on a peduncle, golden-yellow; spur short and incurved. India. B.M. 7786.—*I. comorénsis,* Baker. Lvs. elliptic-lanceolate, acute and crenate: fls. large, bright carmine with 2-parted white spur. Comoro Isls.—*I. comoricoma,* Hort. (I. comorensis×I. auricoma).—*I. cuspidàta,* Wight & Arn. Shrubby, glabrous, farinaceous: lvs. alternate or uppermost opposite, lanceolate or oblong-lanceolate, serrulate: fls. solitary, 1 in. across, very pale red; spur slender. India. Var. *arthrética,* Hook. f., has the lower nodes much thickened. B.M. 7844.—*I. fálcifer,* Hook. f. Annual, more or less decumbent: lvs. alternate, sessile or stalked, ovate to ovate-lanceolate, serrate: fls. solitary and short-pedicelled, ringent, golden yellow spotted blood-red; spur slender, to 1½ in. long. India. B.M. 7923.—*I. Hérzogii,* Schum. Stout branching herb the branches 4-angled: lvs. opposite and whorled, ovate to ovate-lanceolate: fls. sol tary or clustered, about 2 in. across, cinnabar; spur to nearly 3 in. long, very slender, incurved. New Guinea. B.M. 8396. R.H. 1913:12.—*I. Hólstani,* Hort. (I. Holstii×I. Sultani).—*I. kewénsis,* Hort. (I. platypetala×I. Herzogii).—*I. Maridnæ,* Reichb. Annual: lvs. cuneate-oblong and acute, serrate with lighter areas between veins: fls. light purple, cymose; standard with a projection below the tip; lip with slender hooked spur. India. G.W. 14, p. 127.—*I. psittacina,* Hook. f. Annual, leafy and much branched: lvs. alternate, ovate, acuminate, serrate: fls. solitary, oddly colored, 2 sepals green, standard pale rose, wings suffused and streaked red, lip white with irregular dash of carmine; spur short and hooked. Burma. B.M. 7809.—*I. Thómsonii,* Hook. f. Annual, erect, 8–12 in.: lvs. alternate, ovate-lanceolate, serrate: fls. several on a peduncle, ¾in. long, pale rose; spur slender, incurved. India. B.M. 7795.

L. H. B.†

1954. Impatiens Roylei. (×½)

IMPERÀTA SACCHARIFLÒRA: *Miscanthus.*

IMPERATÒRIA: *Peucedanum.*

INCARVÍLLEA (after Incarville, the French Jesuit missionary to China, correspondent of Jussieu in 1743). *Bignoniàceæ.* Showy herbs, annual, biennial, or perennial, planted in the open.

Closely allied to Amphicome, and the fls. of both have the same general appearance, but in Incarvillea the calyx-lobes are awl-shaped, while in Amphicome the calyx is truncate or shortly dentate; also the seeds of Incarvillea have an entire hyaline wing, while in Amphicome the seeds have a wing that is cut into long thin strips or hairs. The two genera form a small but remarkable group, characterized by their caps. opening by the ventral suture only. Calyx campanulate, 5-lobed; corolla-tube elongated, enlarging; limb somewhat 2-lipped, the lobes 5, spreading and broad; stamens 4, included, didynamous; disk annular or ring-like; ovary 2-loculed: fr. a narrow more or less curved caps. with many seeds: plant erect, branching or simple: lvs. alternate, 2–3-pinnate or simple, with narrow segms.: fls. large, in terminal clusters, red to yellow.—Species about a dozen, Turkestan, Thibet, China. The general experience seems to be that these plants need rather more winter protection than most hardy her-

baceous perennials. A light, sandy loam, well enriched and deeply worked, suits them well, and they like a sheltered position in a rather warm, sunny place. Prop. by division or seed.

A. *Lf.-segms. toothed or crenate.*

Delavàyi, Bur. & Franch. Fig. 1955. Lvs. few, radical; lfts. 4–5 in. long, not quite opposite: stamens included. B.M. 7462. Gn. 54:430; 60, p. 229; 72, p. 421. G. 23:157. Gn.W. 15:713. G.W. 15, p. 409. R.H. 1893:544. J.H. III. 30:449. Gt. 43:1398. Mn. 3, p. 26. G.C. III. 26:123. G.M. 38:306.—*I. Delavayi* is a hardy plant with handsome pinnate foliage, each lf. being 1 ft. long, with as many as 15–20 dentate segms.: scape 1–2 ft. high, bearing 2–12 large trumpet-shaped rosy purple fls., each 2–3 in. long and as much wide. These fls. are probably equal in decorative value to many of the bignonias cherished in greenhouses. In size and beauty they rank with those of catalpa, bignonia and tecoma, of the same family. The tube is yellow inside and out, and the 2 upper lobes are smaller than the 3 lower ones.

lùtea, Bur. & Franch. Two to 4 ft.: lvs. mostly radical, 8–15 in. long, pinnate, long-petioled; lfts. broad-lanceolate, crenate: scapes stout and stiff, bearing a few bracts and 6–20 yellow, somewhat pendulous fls., with limb 2 in. across and paler yellow than the tube. S. W. China, 10,000–12,000 ft. altitude. G.C. III. 50, suppl. Aug. 19 (1911).

AA. *Lf.-segms. parted or dissected.*

variàbilis, Batalin. Subshrub: lvs. 2- or 3-pinnate; segms. parted or dissected, their lobes entire or slightly lobed: fls. as many as 10, pale rose. Gt. 47, p. 222.—A strong-growing, bushy plant covered with fls. each 1 in. or more across, from May to Oct.: seedlings bloom the first year.

AAA. *Lf.-segms. often entire or nearly so.*

Ólgæ, Regel (*I. Koòpmannii*, W. Lauche). Subshrub, 2–3 ft. high: lvs. 2–4 in. long; segms. linear-oblong or lanceolate, narrower than in *I. Delavayi*, especially at the base, entire or with a few distant teeth toward the tip: fls. pale pink, veiny; tube 1½ in. long; limb about 1 in. across, the 5 lobes nearly equal. B.M. 6593 (throat not yellow). G.C. II. 19:89. Gn. 28, p. 653.—The hardiest species.

grandiflòra, Bur. & Franch. Differs from *I. Delavayi* in its shorter lvs., more rounded lfts., segms. ovate or broader, short scapes bearing only 1 or 2 fls. as large as those of *I. Delavayi*, but with narrower calyx-lobes and longer corolla-lobes, the color deep rose-red. Dried specimens show about a dozen scapes on a plant. China. Gn. 56:22. J.H. III. 46:357. G. 27:349; 35:145.

1955. Incarvillea Delavayi.

1956. Indigofera decora var. alba. (×½)

G.M. 46:219. Var. **brévipes,** Sprague (*I. Bonvalòtii*, Hort., not Bur. & Franch.), is offered abroad: "large brilliant crimson fls., habit of *I. Delavayi*:" pedicels much shorter than the peduncle. Yunnan, China.

compácta, Maxim. Handsome hardy perennial, glabrous or somewhat pubescent: st. short, becoming 1 ft. or more high: lvs. fleshy or thick, mostly radical, pinnatisect; segms. subcordate-ovate, all more or less decurrent, entire or nearly so: fls. at first congested near the crown, but becoming elevated, purple, the corolla 2–2½ in. long and the limb 1½ in. across; corolla-tube dilated, the limb broad and with roundish lobes; calyx-teeth deltoid, acuminate. N. W. China. Gt. 49:1479.

L. H. B.†

INDIAN BEAN: *Catalpa.* **I. Cherry:** *Rhamnus caroliniana.* **I. Corn:** *Zea Mays.* **I. Cress:** *Tropæolum.* **I. Cucumber-root:** *Medeola virginica.* **I. Currant:** *Symphoricarpos vulgaris.* **I. Fig:** *Opuntia vulgaris.* **I. Hemp:** *Apocynum cannabinum.* **I. Mallow:** *Abutilon.* **I. Physic:** *Gillenia.* **I. Pipe:** *Monotropa.* **I. Rice:** *Zizania aquatica.* **I. Shot:** *Canna.* **I. Tobacco:** *Lobelia inflata.* **I. Turnip:** *Arisæma triphylla.* **I. Wheat:** *Fagopyrum tataricum.*

INDIGO: *Indigofera.* **False Indigo:** *Baptisia* and *Amorpha.*

INDIGÓFERA (*indigo-bearing*). *Leguminòsæ.* INDIGO. Shrubs and perennial herbs sometimes grown for ornament, and some species cultivated in various parts of the world for indigo.

Plants of differing habit, more or less silky-hairy: lvs. odd-pinnate (rarely digitate), or sometimes simple (1-foliolate): fls. usually small, in axillary racemes or spikes, in color ranging from purple to rose and white, papilionaceous; standard mostly roundish, often persisting for some time; keel with a spur or swelling on either side; stamens 10, monadelphous, or 9 and 1: pod various, usually with thin partitions between the seeds.—The species are probably 300, in tropical regions of the world, and extending to the Cape region of S. Afr. Several species are native to the U. S.

Indigo is mostly the product of *I. tinctoria*, of Asia,

but it is also made from the West Indian species, *I. Anil*. These species were early introduced into the southern states for indigo-making, and the product was once manufactured to a considerable extent. The plant was introduced into South Carolina in 1742 from the West Indies. When it was found that commercial indigo could be produced, the British Government offered a bounty. In 1775, the production was more than one million pounds of indigo. The war for independence

1957. Indigofera Kirilowii. (×⅓)

checked the industry, and thereafter the rising importance of the cotton crop, amongst other things, drove it to the wall. But as late as the middle of the last century, indigo continued to be made in remote places. Plants still persist in some places as escapes from cultivation. *I. tinctoria* is perennial, but is grown from seeds, which give from two to four cuttings of herbage the first year. The indigo is not contained in the plant, but the dye is a product of manufacture from a glucoside indican which is contained in the herbage, and which is obtained as an extract. Indigo seed is offered by seedsmen. Other species, even of other genera, also yield indigo. Very much of the indigo of commerce is now manufactured synthetically from coal-tar.

In North America, several species of Indigofera are occasionally grown as ornamental subjects. In the North, they are mostly greenhouse subjects. Propagated by seeds or cuttings, chiefly the latter. Recent introductions are *I. amblyantha* and *I. Kirilowii*, excellent species and hardy at the Arnold Arboretum.

A. *Raceme longer than the lf.*

decòra, Lindl. Weak-growing or even half-climbing shrub, the branches slender and red-tinged: lfts. in 6–8 pairs, broad-lanceolate, usually drooping, sharp-pointed: racemes long, with showy rose-pink fls. about 1 in. long; standard oblong, nearly or quite obtuse, with a heart-like mark near the base; wings linear-lanceolate or spatulate, ciliate. China. B.R. 32:22. B.M. 5063. G.M. 31:591. P.M. 16:290.—Regarded as a greenhouse plant and cult. in the open far S. Var. **álba** (Fig. 1956), with white fls., is a hardy herbaceous or half-shrubby plant at the Arnold Arboretum, Boston. G.F. 7, pp. 266, 376; fig. 61, p. 375 (adapted in Fig. 1956).

macróstachys, Vent. Shrubby, the sts. terete and appressed-pubescent: lfts. 8–10 pairs, oval-oblong, obtuse but mucronate, pubescent: racemes longer than the lvs., many-fld.; fls. rose. China. V.F. 53.

carolinìana, Walt. Tall and branching, 6–7 ft.: lfts. 4–8 pairs, oblong, oval or oblanceolate, mucronate, with slender petiolules: fls. small, many, yellowish brown and with short-acute calyx-teeth: legume oblong, 2-seeded, less than ½in. long.—Perennial, in the pine-barrens from N. C. south.

Kirilòwii, Maxim. Fig. 1957. A beautiful species of recent intro., with fls. as large as those of *Robinia Pseudacacia*, bright rose-color: lvs. petioled: subshrub, 3–4 ft., soon glabrous, the branches slightly angular and bark soon striate: lf.-blade to 5 in. long, the stalk to 1⅕ in.; lfts. about 7–9, usually opposite, elliptic or rounded-elliptic, obtuse and mucronate, to 1¼ in. long and 1 in. wide, both surfaces bearing white hairs attached by their centers: racemes axillary, longer than the lvs., the peduncle about twice as long as the petiole; corolla glabrous nearly throughout when in bud; standard oblong-elliptic, ⅗in. long and half as wide, ciliate; keel acuminate, ciliate, as long as standard; anthers prominently apiculate. N. China, Korea. B.M. 8580. M.D.G. 1912:271.—Prop. by division, suckers and cuttings; appears not to seed in cult.

AA. *Raceme mostly shorter than, or not exceeding, the lf.*

amblyántha, Craib. Upright shrub, 3–6 ft.: young branchlets angled, whitish from appressed hairs: lvs. petioled, 4–6 in. long; lfts. usually opposite, oval to elliptic-oblong, broadly cuneate at the base, rounded and mucronate at the apex, bright green above, glaucescent beneath, appressed-pubescent on both sides, ½–1½ in. long: fls. in axillary slender racemes with the peduncle 2½–4 in. long, very numerous, pink, small, ¼in. long; petals narrow, of nearly equal length; standard spatulate-obovate, upright, incurved at the apex; calyx appressed-pubescent; ovary densely whitish pubescent: pod linear, with both sutures thickened, pubescent, 1½–2 in. long. July–Oct. Cent. China.—A handsome shrub with its numerous dense racemes of small pink flowers blooming all summer and autumn. Hardy at Arnold Arboretum. Prop. by cuttings, and by seeds which are freely produced.

austràlis, Willd. (*I. angulàta*, Lindl. *I. sylvática*, Sieb.). A very variable species, known by its glabrous aspect, short or nearly obsolete teeth of the calyx and the pod glabrous when young. Erect shrub: lfts. 9–17, varying from oblong to almost orbicular, ¾in. or less long, obtuse or retuse: fls. red and mostly showy, the racemes sometimes fully as long as the lvs.; standard truncate at the base with a very short claw: pod nearly or quite straight, terete. Austral. B.M. 3000. B.R. 386; 991. L.B.C. 2:149.

tinctòria, Linn. INDIGO. Fig. 1958. Shrub, 4–6 ft., with silvery branches: lfts. 7–15, thin, rather large, obovate-oblong, pubescent beneath: fls. small, reddish yellow, in short racemes, the pedicels finally recurved; calyx pubescent, the lobes subulate: pod nearly straight, somewhat knotty, 8–12-seeded, about ¾ or 1 in. long. S. Asia.—Long cult. and widely distributed. Runs wild S. Indigo was known to the Egyptians.

Ánil, Linn. WEST INDIAN INDIGO. Fig. 1958. Much like the last, but fls. smaller, and pods curved and not knotty, and about ½in. long. W. Indies, but now runs wild in the southern states. B.M. 6506.

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Gerardiàna, Wall. (*I. Dosùa*, Hort., not Hamilt.). Low much-branched shrub with silvery canescent branchlets: lvs. 1–2 in. long, with thickish opposite pale white bristly lfts. to ½ in. long and oblanceolate-oblong and 9–17 in number: fls. pale red, canescent outside, the peduncled racemes 12–20-fld.: pod to 2 in. long, nearly cylindrical. India. B.R. 28:57.

I. caudàta, Dunn. Shrubby, 3–8 ft., with a coppery pubescence on young growths: fls. white, about ½in. long, in very long tail-like racemes that droop at the end. China.—*I. hebepétala*, Benth. Branching shrub, lightly pubescent when young: lvs. 4–7 in. long; lfts. 4–8 pairs, oblong, about 2 in. long: fls. small, reddish, in short axillary racemes. Himalayas. B.M. 8208.—*I. reticulàta*, Franch. Similar to I. Kirilowii, but dwarfer: lvs. dark shining green: fls. clear white. China, Korea. The plant in cult. may be I. reticulata, Koehne.

L. H. B.

ÍNGA (a West Indian name). *Leguminòsæ*. Tropical trees and shrubs, with acacia-like foliage and clusters of showy red stamens.

Spineless: lvs. abruptly pinnate, usually with glands between the large lfts.: fls. not papilionaceous, in heads, spikes, racemes or umbels, mostly 5-merous; stamens ∞, monadelphous, exserted beyond the small tubular or campanulate corolla: pod narrow, often thickened at the sutures, completely or partially indehiscent.—Species upward of 150, in W. Indies and S. Amer.

A. *Lfts. hairy beneath.*

affínis, DC. Lvs. simply pinnate; lfts. in 4 pairs, ovate, acuminate, pubescent above, somewhat shining and villous below, one side smaller than the other, 3 in. long, 1½ in. wide; petioles, branches, peduncles and fls. velvety tomentose, a gland between each pair of lvs.: spikes solitary or in pairs; corollas villous. Trop. Amer.

1958. Indigofera Anil. (Nearly natural size.) The single pod is I. tinctora. (×½)

AA. *Lfts. not hairy.*

Feuillei, DC. Foliage handsome; lvs. simply pinnate; lfts. in 3–4 pairs, oval-oblong, acute at both ends, glabrous: pods 1–2 ft. long, linear, flat, glabrous, white inside. Peru.—The sweet, edible pulp of the pods is much prized by the Peruvians, who call it pacay. It has ripened its pods in Calif.

I. anómala, Hort.=Dichrostachys nutans.—*I. dúlcis*, Willd.=Pithecolobium.—*I. guadalupénsis*, Desv.=Pithecolobium.

WILHELM MILLER.
L. H. B.†

INGENHOÙZIA (Dr. John Ingenhousz, 1730–1799, famous vegetable physiologist). *Malvàceæ*. A sub-shrubby plant of S. Ariz. and Mex., intro. recently in S. Calif. for ornament. Allied to Gossypium: involucel of 3 triangular-lanceolate entire bracts; calyx saucer-shaped; stigma obscurely 3-lobed; fr. a globular leathery 3-celled and 3-valved caps.; seeds 5–8 in each cell or locule, puberulent. **I. trílоba,** DC. Perennial, 4–10 ft., glabrous: lvs. 3-parted or 5-parted, or the uppermost entire and lanceolate, the lvs. and branches black-dotted: fls. on axillary peduncles, or somewhat corymbose above; petals 1 in. long, pure white turning to rose, dark-dotted. Generic name variously spelled.

INOBÚLBON (in reference to fibrillose bulbs). *Orchidàceæ*. Pseudobulbs short, few-jointed, annulate, fibrillose, few-lvd.: fls. in racemes or panicles; sepals and petals equal, the lateral sepals not forming a mentum; lip 3-lobed, the lateral lobes small, the middle lobe large, with a thick fleshy callus 3-parted disk; column short, footless.—Species 2, New Caledonia.

munífícum, Kränzl. (*Dendròbium muricàtum* var. *munífícum*, Finet). Pseudobulbs about 3 in. long, 1½ in. thick, 2-lvd.: lvs. up to 8 in. long: panicle of few branches, somewhat nodding; sepals and petals greenish, brown-spotted; lip marked with reddish purple and yellow. B.M. 8371.

GEORGE V. NASH.

INÒDES: *Sabal.*

INOPHÝLLUM: *Tahitian chestnut.*

INSECTICIDES, INSECTS: *Diseases and Insects*, p. 1042.

INSPECTION OF HORTICULTURAL MERCHANDISE. — To guard against the introduction of insect pests and plant diseases, governments have instituted inspection service at ports of entry and for interstate commerce. The regulations may be federal, or state or provincial.

The plant-quarantine act.

A federal plant-quarantine act was enacted by Congress August 20, 1912. This act authorizes the Secretary of Agriculture to regulate the importation of nursery stock and other plants and plant-products, and to establish and maintain quarantine districts for plant-diseases and insect pests within the United States, and also to exclude by quarantine diseased plants or plant-products from foreign countries or to provide such regulations governing the entry of such materials as will insure safety.

The first general attempt to secure national legislation of this nature resulted from the introduction of the San José scale into the eastern United States and its threatened general distribution on nursery stock. To meet this emergency, a convention was called in Washington in 1897, composed of the delegates from horticultural societies, nurserymen's associations, state agricultural boards, agricultural colleges and experiment stations—a large and representative body of men. After full discussion a bill was drafted, the primary object of which was the control of domestic nursery stock, but which provided also for the inspection of foreign nursery stock. While this measure received the endorsement of the convention, and was submitted to Congress, the different interests were not fully agreed as to the desirability of all its features, and it was not heartily pushed and was ultimately dropped with the idea of replacing it by a more suitable bill.

During succeeding years, a number of bills covering the same general subject were introduced at the different sessions of Congress, and some of these were reported favorably from the Committee on Agriculture, but the opposition of importing nurserymen prevented any of these measures ever reaching a very advanced stage. In the meantime, various conferences were held between the entomologists of the different states and

horticultural inspectors and the principal nurserymen's associations, without, however, coming to any agreement as to suitable legislation. Finally, in 1908, the promoters of this legislation having become thoroughly discouraged, the project was definitely abandoned,—the San José scale in the meantime having been carried on nursery stock into practically every state in the Union.

The effort which eventually resulted in the enactment of the present law was due to the discovery, in 1909, of the introduction of enormous quantities of brown-tail moth nests full of hibernating larvæ on seedling fruit stock, chiefly from northern France and Belgium. With these were occasional egg-masses of the gipsy-moth. During the years 1909 and 1910, stock infested with thousands of larval nests was sent to no less than twenty-two different states, covering the country from the Atlantic seaboard to the Rocky Mountains. So far as possible, this stock was followed up by state and federal inspectors and the infesting insects destroyed.

This new danger led the writer in 1909 to draft a national quarantine and inspection bill relating particularly to imported nursery stock, and other plants and plant-products offered for entry from foreign countries, but providing also means for quarantining new pests locally established within the United States. This bill promptly passed the House, but was objected to by nurserymen, and was withdrawn with the idea of revising it so as to meet in a satisfactory way these objections. There followed many attempts to draft a measure which would give reasonable protection and be at the same time satisfactory to the nursery interests, and many different bills were introduced in Congress from time to time, all based on the original bill just referred to. Securing desirable legislation of this kind—against a small but organized opposition—is a slow process, and the effort instituted in January, 1909, did not reach fruition until August, 1912. The passage of the act was finally much aided by the hearty coöperation of Californian interests, due to the discovery that the Mediterranean fruit-fly had become thoroughly established in Hawaii and was likely at any time to be carried by Hawaiian fruits to California, and thus jeopardize the vast fruit development of that state.

The bill as passed is a compromise measure, and divides responsibility between the federal government and the state authorities. It, furthermore, gives no control over the interstate movement of domestic nursery stock, except as to areas and plants specifically quarantined.

The scope of this act has been given in an opening paragraph. The system of control of imported nursery stock and a description of the several foreign and domestic plant quarantines and restrictive orders follow.

Control of nursery stock importations.

For the purposes of this act, nursery stock offered for entry into the United States falls into two classes, namely:

1. That coming from countries having an official inspection and certification system, and

2. From countries which have no system of inspection or certification.

Nursery stock from the first class of countries, arrives with some assurance of freedom, or at least the responsibility for its condition fixed on some known foreign official.

Nursery stock from the second class of countries arrives with no information as to its probable freedom from infestation by insects or diseases.

Commercial importations are permitted only from the countries belonging to the first category, and from countries belonging to the second category importations are limited by regulation and permitted only for experimental or scientific purposes. Mail importations are not permitted except of field, vegetable, and flower seeds.

The following countries have provided for inspection and certification of export plants and plant-products in conformity with the regulations under the plant-quarantine act: Australia, Barbados, Belgium, Bermuda, British Guiana, Canada, Cuba, Denmark, England, France, Germany, Guatemala, Holland, Ireland, Japan, Leeward Islands, Antigua, St. Christopher-Nevis, Dominica, Montserrat, Virgin Islands, Grand Duchy of Luxemburg, New Zealand, Scotland, Union of South Africa, Straits Settlements, Switzerland, Trinidad, Wales, Windward Islands, Granada, St. Lucia, and St. Vincent; and these include most of the countries which have hitherto maintained any considerable commerical trade in nursery stock with the United States. Any other country may obtain the benefits of commercial exportation by providing for the proper inspection and certification of exported stock. The Italian government has indicated that the Province of Padua will certify export nursery stock, and a national law has been passed with the object of ultimately meeting for the country as a whole the requirements of the plant-quarantine act.

The federal act has very greatly stimulated those foreign countries which have considerable commercial trade in plants with the United States to do better work of inspection and to provide suitable legislation and officers to meet the requirements of the act.

The United States is no longer a dumping-ground for any sort of infested and diseased stock. Brown-tail moth and gipsy-moth infestation has practically ceased, insect infestation by any important pest is rare, and the general condition of the stock has been very much improved.

In general explanation of the federal powers in relation to the importation of nursery stock, it may be said that these powers relate (1) to the issuance of permits for the importation of nursery stock, (2) the provision for foreign inspection and certification as a condition of entry, and (3) the distribution to the several state inspectors of exact information in regard to the origin, arrival, and destination of the imported stock.

To the several states is left the entire responsibility for the inspection at destination of commercial importations of nursery stock, and, if this inspection is not done by state inspectors, there is nothing in the federal law to make good this neglect. Most of the states have made fairly adequate provision for such inspection, and this inspection, as shown by the pests intercepted and destroyed, has been of tremendous value.

Foreign plant quarantines.

Under the provisions of Section 7 of the plant-quarantine act, the following foreign plant-quarantines have been established:

White pine blister-rust.—This is Quarantine No. 1, promulgated September 16, 1912, and amended and superseded by Quarantine No. 7, promulgated May 21, 1913. This quarantine was drawn to prevent the introduction into the United States of the white pine blister-rust, and forbids the importation into the United States from each and every country of Europe and Asia of all five-leafed pines.

Potato wart.—This is Quarantine No. 3, promulgated September 20, 1912, to prevent the introduction into the United States of the disease known as "potato wart," "potato canker," "black scab," and the like, and forbids the importation into the United States from the countries of Newfoundland, the islands of St. Pierre and Miquelon, Great Britain and Ireland, Germany, and Austria-Hungary, of the common or Irish potato (*Solanum tuberosum*).

Mexican fruit-fly.—This is Quarantine No. 5, and

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was promulgated January 15, 1913, to prevent the introduction into the United States from Mexico of the insect known as the Mexican fruit-fly (*Trypeta ludens*), and forbids the importation into the United States from the Republic of Mexico of the following fruits: oranges, sweet limes, mangoes, *Achras Sapota*, peaches, guavas, and plums. It was amended February 8, 1913, to include, in addition to the above fruits, the grapefruit and its horticultural varieties.

Pink boll-worm of cotton.—This is Quarantine No. 8, promulgated May 28, 1913, to prevent the introduction into the United Sates of the pink boll-worm of cotton, and forbids the importation into the United States of cotton-seed of all species and varieties and cotton-seed hulls from any foreign locality and country, excepting only the locality of the Imperial Valley in the state of Lower California in Mexico. The importation from the region specified in Mexico is governed by regulations. By later amendments this quarantine was lifted and cotton-seed and seed-cotton were permitted to be entered, under regulations, from the Mexican states of Neuvo Leon, Tamaulipas, Coahuila, Durango, and Chihuahua.

Potato quarantine.—This is Quarantine No. 11, promulgated December 22, 1913, to prevent the introduction into the United States of the disease known as powdery scab (*Spongospora subterranea*), and forbids the importation into the United States from the Dominion of Canada, Newfoundland, the islands of St. Pierre and Miquelon, Great Britain, Ireland and Continental Europe, of the common or Irish potato (*Solanum tuberosum*), until such time as it shall have been ascertained to the satisfaction of the Secretary of Agriculture that the country or locality from which potatoes are offered for import is free from powdery scab and other injurious potato diseases. Amendments 1 and 2, February 20; 3, March 12; and 5, November 30, 1914, eliminate Belgium, Denmark, and the Netherlands, and the Dominion of Canada, from the provisions of this quarantine and make it possible to import potatoes under regulation from these countries. The importation under regulation is also now permitted from Bermuda, Santo Domingo, and the states of Chihuahua and Sonora, Mexico. Amendment 4 to this quarantine, promulgated June 25, 1914, eliminates the territory of Porto Rico from its provisions.

Avocado seed quarantine.—This is Quarantine No. 12, promulgated February 27, 1914, to prevent the introduction into the United States of the avocado weevil (*Heilipus lauri*), and forbids the importation into the United States of the seeds of the avocado or alligator pear from Mexico and the countries of Central America.

Sugar-cane quarantine.—This is Quarantine No. 15, promulgated June 6, 1914, to prevent the introduction into the United States of injurious insects and fungous diseases of the sugar-cane, and forbids the importation into the United States, from all foreign countries of living canes of sugar-cane, or cuttings or parts thereof. This quarantine does not apply to Hawaii and Porto Rico.

These foreign quarantine orders are absolute prohibitions of the entry of the goods covered, and are enforced through the active coöperation of the customs service of the Treasury Department.

Domestic plant quarantines.

Under the provisions of section 8 of the plant-quarantine act the following domestic plant-quarantines have been established:

Mediterranean fruit-fly.—This is Quarantine No. 2, promulgated September 18, 1912, to protect the United States from the entry of the Mediterranean fruit-fly, now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits and vegetables specified in the notice of quarantine into or through any other state, territory, or district of the United States.

Gipsy-moth and brown-tail moth.—This is Quarantine No. 4, promulgated November 5, 1912, and revised and amended as Quarantine No. 10, June 24, 1913, and as Quarantine No. 17, July 3, 1914. This quarantine describes and quarantines the districts in New England infested by the two moths named, and makes regulations governing the movement in interstate commerce of plants and plant-products which may be infested from the areas quarantined.

Date-palm scale insects.—This is Quarantine No. 6, promulgated March 1, 1913, to prevent the further distribution in the United States of two important date-palm scale insects. It quarantines certain counties in California, Arizona and Texas, and makes regulations governing the interstate movement of date palms originating within the areas quarantined.

Pink boll-worm of cotton.—This is Quarantine No. 9, promulgated June 24, 1913, and applies to the territory of Hawaii. It has the same object as the foreign quarantine on the same subject, described above. It prevents the movement from the territory of Hawaii into or through any other state, territory or district of the United States of all cotton-seed and cotton-seed hulls.

Mediterranean fruit-fly and melon-fly.—This is Quarantine No. 2, promulgated September 18, 1913, and revised and amended as Quarantine No. 13, promulgated March 23, 1914, to protect the United States from the entry of the Mediterranean fruit-fly (*Ceratitis capitata*) and the melon-fly (*Dacus cucurbitæ*), now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits, nuts and vegetables specified in the notice of quarantine into or through any other state, territory or district of the United States, in accordance with the regulations prescribed under this quarantine. This quarantine became effective May 1, 1914.

Powdery scab of potatoes.—This is Quarantine No. 14, promulgated April 25, 1914, to prevent the further distribution in the United States of the dangerous potato disease known as powdery scab (*Spongospora subterranea*), which exists in certain parts of the state of Maine. This quarantine became effective August 1, 1914.

Sugar-cane quarantine.—This is Quarantine No. 16, promulgated June 6, 1914, to prevent the further distribution in the United States of certain injurious insects and fungous diseases of the sugar-cane existing in the territories of Hawaii and Porto Rico, and forbids the movement from the territories named into or through any other state, territory or district of the United States of living canes of sugar-cane, or cuttings or parts thereof.

Most of the domestic quarantines provide for the movement of the quarantined articles under a system of inspection and certification. The very considerable work of inspection and certification necessitated, particularly in the case of the moth quarantine in New England and the Mediterranean fruit-fly quarantine in Hawaii, is done under federal authority, in coöperation with state and insular officers, who are made for that purpose collaborators of the Department of Agriculture.

Regulatory orders.

Under the authority given by section 5 of the plant-quarantine act, orders placing restrictions on the importation of potatoes and avocados have been promulgated.

The order restricting the admission of all foreign potatoes not under quarantine was issued December 22, 1913, and regulations governing the entry of potatoes under this order into the United States were issued December 30, 1913. This order specifies that potatoes may be imported only from countries which are free

from injurious potato diseases and insect pests and under permit and prior foreign inspection and certification. All such imported potatoes are subject to a second inspection by a federal inspector on their arrival in this country.

The order governing the admission of the avocado or alligator pear under restriction was issued February 27, 1914. These two orders are supplemental to the quarantine orders described above in relation to the potato and to avocada seed.

The federal horticultural board.

The act provides (section 12) that for the purpose of carrying out its provisions there shall be appointed by the Secretary of Agriculture from existing bureaus and offices in the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service, a Federal Horticultural Board consisting of five members, of whom not more than two shall be appointed from any one bureau or office, and who shall serve without additional compensation.

State legislation.

The state of California for the last twenty years has enforced a quarantine at the port of San Francisco, and has had quarantine and other control legislation which has furnished protection to the state of untold value, and to a less degree to the remainder of the United States. A few other states have had minor plant-legislation, but the San José scale outbreak in the East in the early nineties, already referred to, was the inciting cause of plant-legislation in nearly every state of the Union. This legislation, chiefly in relation to domestic nursery stock, lacks uniformity, and thus entails unnecessary difficulty to dealers in nursery and other plant stock. An effort has been under way for several years to devise, for general adoption, a uniform nursery and plant act, and it seems now possible that uniform legislation may eventually be secured. A bill has been drafted by J. G. Sanders, State Entomologist of Wisconsin, as Chairman of a Committee on Uniform State Legislation of the American Association of Horticultural Inspectors, and this bill has been approved by this association, representing the different states and by the National Nurserymen's Association. It will probably be many years, however, before it is generally substituted for present state legislation on this subject.

Space at disposal does not permit of a full analysis of the plant legislation of the different states. This legislation has been well summarized in Circular No. 103 of the Department of Agriculture of the state of New York. Shippers of nursery stock should first inquire as to legislation, which may vary from year to year, of any state to which goods are to be sent. Many of the states also require the taking out of licenses, and in some states imported nursery stock must be reëxamined by local state inspectors before it can be liberated.

Plant legislation in Canada.

The Canadian legislation to control the entry of injurious insect pests and plant-diseases has much the same history as the similar legislation in the United States and the same inciting causes. The San José scale excitement in the United States led in 1898 to the passage by Canada of the San José Scale Act which prohibited the importation of nursery stock from all countries in which this scale insect occurred. Later (1901) this prohibition was removed and nursery stock from countries in which the scale occurred was allowed to enter, subject to fumigation with hydrocyanic-acid gas,—the ports of entry and the time of the year when such entry could be made being limited. In 1909 brown-tail moth nests were found on shipments of nursery stock to Canada and this led to the enactment of the "Destructive Insect and Pest Act" of May, 1910. This act provides either for the prohibition of entry, fumigation on entry, or inspection subsequent to entry, of nursery stock, and gives other conditions governing the introduction of living plants. The act has been amended by additional regulations from time to time, particularly in relation to the chestnut-bark disease, the Mediterranean fruit-fly, potato diseases, and forest products from New England.

Canadian provincial legislation.

In addition to the legislation of the Dominion of Canada against insect pests and plant-diseases, several of the provincial governments have enacted similar laws. With the exception, however, of the provinces of British Columbia and Nova Scotia, the provincial governments restrict their attention to the control of pests within their territories. The provinces of British Columbia and Nova Scotia, however, inspect and fumigate, if necessary, nursery stock and fruit imported into these provinces. Nova Scotia fumigates and inspects stock coming from other parts of Canada only. As in the case of the United States, there is coöperation between the inspection service of the Dominion and provincial governments. The full text of the Canadian Dominion and provincial laws in relation to this subject may be obtained from the Dominion Department of Agriculture, Ottawa.

C. L. MARLATT.

Quarantine laws.

State quarantine laws are now in a transition stage. For two or three years there has been active propaganda for uniform state legislation looking to the control of destructive insects and plant diseases. The statutory requirements in the different states are so unlike as to cause much annoyance, and state departments of agriculture or other bodies issue circulars explaining these different requirements for the guidance of nurserymen and others. The bill drafted by the Sanders Committee, already mentioned, has been practically completed, and now awaits enactment. At the request of the Federal Horticultural Board, the Solicitor of the United States Department of Agriculture has drawn a bill for enactment by the different states, to constitute a general plant act rather than a nursery-stock act. Several states are now proposing to enact this draft.

Even in view of the tentative character of much of the legislation, it seems to be well to reprint here a few of the standard or most important statutes. The Canadian law is the simplest and most direct. It embodies in a few words the power to control the entry of plants from foreign countries and also to control the plants within the Dominion. Under the federal and state constitutions in the United States, such a brief and simple law seems to be impossible. There are here printed, the Canadian law; the United States law; and the laws of New York and California.

The ideal law is probably one that confers broad powers, and then leaves the details to regulation so that necessary minor changes may be made as circumstances arise. There must naturally be considerable discretion conferred on competent officers or authorities in dealing with such subjects as quarantine of insects and plant diseases.

Under the federal quarantine act of the United States, some twenty quarantines have now been laid and several of these have required rather elaborate regulations, and modifying orders and amendments have been issued; these matters cannot, of course, be entered here.

Some of the leading sections in the Sanders' bill, now proposed for legislation in the different statee, are reprinted on pages 1653 and 1654. This bill is likely to become of much importance in inspection legislation.

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The Destructive Insect and Pest Act of Canada (May 4, 1910).

1. This Act may be cited as *The Destructive Insect and Pest Act.*

2. In this Act, unless the context otherwise requires, 'the Minister' means 'the Minister of Agriculture.'

3. The Governor in Council may make such regulations as are deemed expedient to prevent the introduction or admission into Canada, or the spreading therein, of any insect, pest or disease destructive to vegetation.

4. Such regulations may provide,—

(*a*) for the prohibition generally, or from any particular country or place, of the introduction or admission into Canada of any vegetable or other matter likely to introduce any such insect, pest or disease;

(*b*) the terms or conditions upon, and the places at which any such vegetable or other matter may be introduced or admitted into Canada;

(*c*) for the treatment and manner of treatment to be given to any vegetation, vegetable matter or premises in order to prevent the spreading of any such insect, pest or disease, and may prescribe whether such treatment shall be given by the owner or by a person appointed for such purpose;

(*d*) for the destruction of any crop, tree, bush or other vegetation or vegetable matter or containers thereof infested or suspected to be infested with any such insect, pest or disease;

(*e*) for the granting of compensation for any such crop, tree, bush or other vegetation or containers thereof so destroyed, such compensation not to exceed two-thirds of the value of the matter destroyed and to be granted only by the Governor in Council upon the recommendation of the Minister;

(*f*) for the prohibition of the sale of any vegetable matter infected with any such insect, pest or disease;

(*g*) that the occupier of the premises on which is discovered any such insect, pest or disease shall forthwith notify the Minister and shall also send specimens of such insect, pest or disease;

(*h*) for the confiscation of any vegetable matter and the container thereof, if any, in respect of which a breach of this Act, or any regulation made thereunder, is committed, and generally for any other purpose which may be deemed expedient for carrying out this Act, whether such other regulations are of the kind enumerated in this section or not.

5. The Minister may appoint inspectors and other officers for carrying out this Act and the regulations made thereunder.

(2) Such appointments, if not confirmed by the Governor in Council within thirty days of the date thereof, shall lapse and cease to be valid.

6. Any inspector or other officer so appointed may enter any place or premises in which he has reason to believe there exists any such insect, pest or disease, and may take specimens thereof and also of any vegetable matter infested or suspected of being infested therewith.

7. The Minister, upon the report of any inspector setting forth a reasonable belief of the existence of any such insect, pest or disease in any area defined in such report, may prohibit the removal from such area or the movement therein of any vegetation, vegetable or other matter which, in his opinion, is likely to result in the spread of such insect, pest or disease.

8. Every person who contravenes any provision of this Act, or any regulation made thereunder, shall be liable, upon summary conviction, to a fine not exceeding one hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment. Any vegetable or other matter imported or brought into Canada contrary to this Act, or to any regulation made thereunder, shall be forfeited to the Crown.

9. Every order in council and regulation made under this Act shall be published in "The Canada Gazette," and shall be laid, by the Minister, before Parliament within fifteen days after the commencement of the then next session.

The United States Plant Quarantine.

AN ACT To regulate the importation of nursery stock and other plants and plant products; to enable the Secretary of Agriculture to establish and maintain quarantine districts for plant diseases and insect pests; to permit and regulate the movement of fruits, plants, and vegetables therefrom, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any person to import or offer for entry into the United States any nursery stock unless and until a permit shall have been issued therefor by the Secretary of Agriculture, under such conditions and regulations as the said Secretary of Agriculture may prescribe, and unless such nursery stock shall be accompanied by a certificate of inspection, in manner and form as required by the Secretary of Agriculture, of the proper official of the country from which the importation is made, to the effect that the stock has been thoroughly inspected and is believed to be free from injurious plant diseases and insect pests: *Provided*, That the Secretary of Agriculture shall issue the permit for any particular importation of nursery stock when the conditions and regulations as prescribed in this act shall have been complied with: *Provided further*, That nursery stock may be imported for experimental or scientific purposes by the Department of Agriculture upon such conditions and under such regulations as the said Secretary of Agriculture may prescribe: *And provided further*, That nursery stock imported from countries where no official system of inspection for such stock is maintained may be admitted upon such conditions and under such regulations as the Secretary of Agriculture may prescribe.

Sec. 2. That it shall be the duty of the Secretary of the Treasury promptly to notify the Secretary of Agriculture of the arrival of any nursery stock at port of entry; that the person receiving such stock at port of entry shall, immediately upon entry and before such stock is delivered for shipment or removed from the port of entry, advise the Secretary of Agriculture or, at his direction, the proper State, Territorial, or District official of the State or Territory or the District to which such nursery stock is destined, or both, as the Secretary of Agriculture may elect, of the name and address of the consignee, the nature and quantity of the stock it is proposed to ship, and the country and locality where the same was grown. That no person shall ship or offer for shipment from one State or Territory or District of the United States into any other State or Territory or District, any nursery stock imported into the United States without notifying the Secretary of Agriculture or, at his direction, the proper State, Territorial, or District official of the State or Territory or District to which such nursery stock is destined, or both, as the Secretary of Agriculture may elect, immediately upon the delivery of the said stock for shipment, of the name and address of the consignee, of the nature and quantity of stock it is proposed to ship, and the country and locality where the same was grown, unless and until such imported stock has been inspected by the proper official of a State, Territory, or District of the United States.

Sec. 3. That no person shall import or offer for entry into the United States any nursery stock unless the case, box, package, crate, bale, or bundle thereof shall be plainly and correctly marked to show the general nature and quantity of the contents, the country and locality where the same was grown, the name and address of the shipper, owner, or person shipping or forwarding the same, and the name and address of the consignee.

Sec. 4. That no person shall ship or deliver for shipment from one State or Territory or District of the United States into any other State or Territory or District any such imported nursery stock the case, box, package, crate, bale, or bundle whereof is not plainly marked so as to show the general nature and quantity of the contents, the name and address of the consignee, and the country and locality where such stock was grown, unless and until such imported stock has been inspected by the proper official of a State, Territory, or District of the United States.

Sec. 5. That whenever the Secretary of Agriculture shall determine that the unrestricted importation of any plants, fruits, vegetables, roots, bulbs, seeds, or other plant products not included by the term "nursery stock" as defined in section six of this act may result in the entry into the United States or any of its Territories or Districts of injurious plant diseases or insect pests, he shall promulgate his determination, specifying the class of plants and plant products the importation of which shall be restricted and the country and locality, where they are grown, and thereafter, and until such promulgation is withdrawn, such plants and plant products imported or offered for import into the United States or any of its Territories or Districts shall be subject to all the provisions of the foregoing sections of this act: *Provided*, That before the Secretary of Agriculture shall promulgate his determination that the unrestricted importation of any plants, fruits, vegetables, roots, bulbs, seeds or other plant products not included by the term "nursery stock" as defined in section six of this act may result in the entry into the United States or any of its Territories or Districts of injurious plant diseases or insect pests he shall, after due notice, give a public hearing, under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney.

Sec. 6. That for the purpose of this act the term "nursery stock" shall include all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs and other plants and plant products for propagation, except field, vegetable, and flower seeds, bedding plants, and other herbaceous plants, bulbs, and roots.

Sec. 7. That whenever, in order to prevent the introduction into the United States of any tree, plant, or fruit disease or of any injurious insect, new to or not theretofore widely prevalent or distributed within and throughout the United States, the Secretary of Agriculture shall determine that it is necessary to forbid the importation into the United States of any class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products from a country or locality where such disease or insect infestation exists, he shall promulgate such determination, specifying the country and locality and the class of nursery stock or other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products which, in his opinion, should be excluded. Following the promulgation of such determination by the Secretary of Agriculture, and until the withdrawal of the said promulgation by him, the importation of the class of nursery stock or of other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the said promulgation from the country and locality therein named, regardless of the use for which the same is intended, is hereby prohibited; and until the withdrawal of the said promulgation by the Secretary of Agriculture, and notwithstanding that such class of nursery stock, or other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products be accompanied by a certificate of inspection from the country of importation, no person shall import or offer for entry into the United States from any country or locality specified in such promulgation, any of the class of nursery stock or of other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products named therein, regardless of the use for which the same is intended: *Provided*, That before the Secretary of Agriculture shall promulgate his determination that it is necessary to forbid the importation into the United States of the articles named in this section he shall, after due notice to interested parties, give a public hearing,

under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney: *Provided further*, That the quarantine provisions of this section, as applying to the white-pine blister rust, potato wart, and the Mediterranean fruit fly, shall become and be effective upon the passage of this act: *Provided further*, That hereafter any class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products of which the importation may be forbidden from any country or locality under the provisions of section seven of the Plant Quarantine Act approved August twentieth, nineteen hundred and twelve (Thirty-seventh Statutes, page three hundred and fifteen), may be imported for experimental or scientific purposes by the Department of Agriculture upon such conditions and under such regulations as the said Secretary of Agriculture may prescribe.

SEC. 8. That the Secretary of Agriculture is authorised and directed to quarantine any State, Territory, or District of the United States, or any portion thereof, when he shall determine the fact that a dangerous plant disease or insect infestation, new to or not theretofore widely prevalent or distributed within and throughout the United States, exists in such State or Territory or District; and the Secretary of Agriculture is directed to give notice of the establishment of such quarantine to common carriers doing business in or through such quarantined area, and shall publish in such newspapers in the quarantined area as he shall select notice of the establishment of quarantine. That no person shall ship or offer for shipment to any common carrier, nor shall any common carrier receive for transportation or transport, nor shall any person carry or transport from any quarantined State or Territory or District of the United States, or from any quarantined portion thereof, into or through any other State or Territory or District, any class of nursery stock or any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine except as hereinafter provided. That it shall be unlawful to move or allow to be moved any class of nursery stock or any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine hereinbefore provided, and regardless of the use for which the same is intended, from any quarantined State or Territory or District of the United States, or quarantined portion thereof, into or through any other State of Territory or District, in manner or method or under conditions other than those prescribed by the Secretary of Agriculture. That it shall be the duty of the Secretary of Agriculture to make and promulgate rules and regulations which shall permit and govern the inspection, disinfection, certification, and method and manner of delivery and shipment of the class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine hereinbefore provided, and regardless of the use for which the same is intended, from a quarantined State or Territory or District of the United States, or quarantined portion thereof, into or through any other State or Territory or District; and the Secretary of Agriculture shall give notice of such rules and regulations as hereinbefore provided in this section for the notice of the establishment of quarantine: *Provided*, That before the Secretary of Agriculture shall promulgate his determination that it is necessary to quarantine any State, Territory, or District of the United States, or portion thereof, under the authority given in this section, he shall, after due notice to interested parties, give a public hearing under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney.

SEC. 9. That the Secretary of Agriculture shall make and promulgate such rules and regulations as may be necessary for carrying out the purposes of this act.

SEC. 10. That any person who shall violate any of the provisions of this act, or who shall forge, counterfeit, alter, deface, or destroy any certificate provided for in this act or in the regulations of the Secretary of Agriculture, shall be deemed guilty of a misdemeanor and shall, upon conviction thereof, be punished by a fine not exceeding $500 or by imprisonment not exceeding one year, or both such fine and imprisonment, in the discretion of the court: *Provided*, That no common carrier shall be deemed to have violated the provisions of any of the foregoing sections of this act on proof that such carrier did not knowingly receive for transportation or transport nursery stock or other plants or plant products as such from one State, Territory, or District of the United States into or through any other State, Territory, or District; and it shall be the duty of the United States attorneys diligently to prosecute any violations of this act which are brought to their attention by the Secretary of Agriculture or which come to their notice by other means.

SEC. 11. That the word "person" as used in this act shall be construed to import both the plural and the singular, as the case demands, and shall include corporations, companies, societies, and associations. When construing and enforcing the provisions of this act, the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

SEC. 12. That for the purpose of carrying out the provisions of this act there shall be appointed by the Secretary of Agriculture from existing bureaus and offices in the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service, a Federal Horticultural Board consisting of five members, of whom not more than two shall be appointed from any one bureau or office, and who shall serve without additional compensation.

SEC. 13. That there is hereby appropriated, out of the moneys in the Treasury not otherwise appropriated, to be expended as the Secretary of Agriculture may direct, for the purposes and objects of this act, the sum of $25,000.

SEC. 14. That this act shall become and be effective from and after the first day of October, nineteen hundred and twelve, except as herein otherwise provided.

THE NEW YORK LAW TO REGULATE THE SALE OF FRUIT-BEARING TREES (April 15, 1914).

Section 1. The title of article eleven of chapter nine of the laws of nineteen hundred and nine, entitled "An act in relation to agriculture, constituting chapter one of the consolidated laws," is hereby amended to read as follows:

Apples; pears; peaches; quinces; fruit-bearing trees.

§ 2. Such chapter is hereby amended by adding at the end of article eleven three new sections to be sections two hundred and sixty-three, two hundred and sixty-four and two hundred and sixty-five, to read, respectively, as follows:

§ 263. *Sale of fruit-bearing trees.* Every person, firm or corporation selling fruit-bearing trees shipped from any point in the state of New York must have attached to each car, box, bale or package a copy of a certificate of inspection issued by the state department of agriculture and signed by the commissioner of agriculture, valid to the first day of September next following the date of issuance thereof. There shall also be attached to each bundle or package of such fruit-bearing trees a label specifying the name of variety of trees contained therein. In case such bundle or package shall contain trees of different kinds or varieties there must be attached to each tree therein a like label.

§ 264. *Damages accruing from sale of trees.* Nothing contained in section two hundred and sixty-three or any other section of this chapter shall be construed to deprive a purchaser of any fruit-bearing tree of his remedy at law in a civil action to recover damages sustained by reason of such trees proving untrue to name as specified on the label. Such damages may be recovered in a civil action by the purchaser of such fruit-bearing trees or by his personal representative or assignee at any time prior to the third bearing year, provided the purchaser notifies the seller as soon as he has reason to believe that such trees are not true to name. In any action to recover damages suffered by the purchaser by reason of any fruit tree or trees not being of the name or variety under which they were tagged and sold, the seller shall have the burden of proof in establishing that any contract not in writing or any provision of any such contract exempting the seller from liability or limiting his liability was fully understood and agreed to by the purchaser. In every case of a sale of fruit-bearing trees in lots of twenty-five or more, when by written contract, the seller must at once furnish the purchaser a copy of such contract upon the face of which shall be plainly printed the following: "In any action to recover damages suffered by the purchaser by reason of any fruit tree or trees not being of the name or variety under which they were tagged and sold, the seller shall have the burden of proof in establishing that any contract not in writing or any provision of any such contract exempting the seller from liability or limiting his liability was fully understood and agreed to by the purchaser." The seller must also accompany the shipment of such trees with an itemized list of the same, which lists shall also give the name of the county and state where the trees covered by it were grown, the age of the trees, and the name and address of the person for whom the trees were grown, if requested by letter or in writing on the contract by the purchaser at the time of purchase. Within five days after the receipt by the purchaser of the trees and the list thereof the purchaser shall compare and notify the seller of any discrepancy between the list and the labels on such trees.

§ 265. *Agent to carry certificate of authority.* Any person, firm or corporation acting as agent for another in the sale of fruit-bearing trees in this state shall carry with him, at all times when engaged in selling trees, a certificate in writing signed by his principal and properly acknowledged, showing his authority to act as such agent and upon request shall exhibit the same to the purchaser and shall leave with the purchaser a copy of the contract bearing on its face the clause referred to in section two hundred and sixty-four.

§ 3. This act shall take effect September first, nineteen hundred and fourteen.

THE HORTICULTURAL QUARANTINE LAW OF CALIFORNIA.

AN ACT to provide for the protection of horticulture and to prevent the introduction into this state of insects or diseases, or animals, injurious to fruit or fruit trees, vines, bushes or vegetables, providing for a quarantine for the enforcement of this act, making a violation of the terms of the act a misdemeanor, and providing the penalty therefor; providing that said act shall be an urgency measure and go into effect immediately, and repealing that certain act entitled "An act for the protection of horticulture and to prevent the introduction into this state of insects, or diseases, or animals, injurious to fruit or fruit trees, vines, bushes or vegetables, and to provide for a quarantine for the enforcement of this act," approved March 11, 1899.

The people of the State of California do enact as follows:

SECTION 1. Any person, persons, firm or corporation who shall receive, bring or cause to be brought into the State of California, any nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds or fruit pits, or fruit or vegetables, or seed, shall immediately after the arrival thereof notify the state commissioner of horticulture, or deputy quarantine officer, or quarantine guardian

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of the district or county in which such nursery stock, or fruit or vegetables or seed are received, of their arrival, and hold the same without unnecessarily moving the same, or placing such articles where they may be harmful, for the immediate inspection of such state commissioner of horticulture, or deputy quarantine officer or guardian. If there is no quarantine guardian or state horticultural quarantine officer in the county where such nursery stock or fruit or vegetable, or seed is received, it shall then be the duty of such person, persons, firm or corporation to notify the state commissioner of horticulture, who shall make immediate arrangements for their inspection. The state commissioner of horticulture, deputy quarantine officer, quarantine guardian or such person or persons as shall be commissioned by the state commissioner of horticulture to make such inspection, or to represent said commissioner, is hereby authorized and empowered to enter at any time into any car, warehouse, depot or upon any ship within the boundaries of the State of California whether in the stream or at the dock, wharf, mole, or any other place where such nursery stock or fruit or vegetables or seed or other described articles are received or in which such nursery stock or fruit or vegetables or seed is imported into the state, for the purpose of making the investigation or examination to ascertain whether such nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, fruit, vegetables or seed is infested with any species of injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease.

If after such examination or inspection, any of the said described articles are found to be so infested or infected as aforesaid, then it shall be the duty of the owner, owners, or persons, firm or corporation having charge or possession thereof to so disinfect at his or their expense such portion or portions of the ship, dock, wharf, mole, car, warehouse or depot where said articles may have been located in such a manner as to destroy all infection or infestation present or that is liable to be present, and all articles or packages or soils apt to be so infested or infected shall be held until the said articles or packages or soils have been thoroughly disinfected and all injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease have been eradicated and destroyed; *provided, however*, that all articles of nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, fruits, vegetables or seed which are infested or infected with such species of injurious insects or their eggs, larvæ or pupæ or other animal or plant disease which may be or be liable to be injurious to the orchards, vineyards, gardens or farms within said state, shall be destroyed or reshipped out of the state as hereinafter provided. The said officer so making such inspection shall not permit any of the described articles so coming in contact with said infested or infected articles or any articles which might convey infection or infestation to be removed or taken from any such car, warehouse, depot, ship, dock, wharf or any other place until after such infection or infestation shall have been destroyed.

SEC. 2. Each carload, case, box, package, crate, bale or bundle of trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, or fruit or vegetables or seed, imported or brought into this state, shall have plainly and legibly marked thereon in a conspicuous manner and place the name and address of the shipper, owner, or owners or person forwarding or shipping the same, and also the name of the person, firm or corporation to whom the same is forwarded or shipped, or his or its responsible agents, also the name of the country, state or territory where the contents were grown and a statement of the contents therein.

SEC. 3. When any shipment of nursery stock, trees, vines, plants, shrubs, cuttings, grafts, scions, buds, fruit pits or seed or vegetables or fruit, imported or brought into this state, is found infested or infected with any species of injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease or there is reasonable cause to presume that they may be so infested or infected, which would cause damage, or be liable to cause damage, to the orchards, vineyards, gardens or farms of the State of California, or which would be or be liable to be detrimental thereto or to any portion of said state, or to any of the orchards, vineyards, gardens or farms within said state such shipment shall be immediately destroyed by the state commissioner of horticulture, his deputy quarantine officer, quarantine guardians or other person or persons, who shall be commissioned by the state commissioner of horticulture to make such inspection; *provided, however*, that if the nature of the injurious insects, or their eggs, larvæ, pupæ or animal or plant disease be such that no damage or detriment can be caused to the said orchards, vineyards, gardens or farms of California or any of the same by the shipment of the same out of the state, then the said state commissioner of horticulture, his deputy quarantine officer, quarantine guardians or other person or persons who shall be commissioned by the state commissioner of horticulture to make such inspection, and who shall make such inspection, shall notify the owner or person, firm or corporation having possession or control of said articles to ship the same out of the state within forty-eight hours after such notification, and it shall be the duty of such owner or owners, or person, firm or corporation, to so ship said articles, but such shipment shall be under the sole direction and control of the officer so making the inspection and shall be at the expense of the owner or owners, his or their agent or agents, and for a failure to comply with such notice such owner or owners, his or their agent or agents shall be deemed guilty of a violation of the terms of this act and be punished accordingly and immediately after the expiration of the time specified in said notice said articles shall be seized and destroyed by said officer at the expense of the said owner or owners, his or their agent or agents.

SEC. 4. When any shipment of nursery stock, trees, vines, plants, shrubs, cuttings, grafts, scions, fruit, fruit pits, vegetables or seed, or any other horticultural or agricultural product passing through any portion of the State of California in transit, is infested or infected with any species of injurious insects, their eggs, larvæ or pupæ or animal or plant disease, which would cause damage, or be liable to cause damage to the orchards, vineyards, gardens or farms of the State of California, or which would be, or be liable to be, detrimental thereto or to any portion of said state, or to any of the orchards, vineyards, gardens or farms within said state, and there exists danger of dissemination of such insects or disease while such shipment is in transit in the State of California, then such shipment shall be placed within sealed containers, composed of metallic or other material, so that the same can not be broken or opened, or be liable to be broken or opened, so as to permit any of the said shipment, insects, their eggs, larvæ or pupæ or animal or plant disease to escape from such sealed containers and the said containers shall not be opened while within the State of California.

SEC. 5. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any fruit or vegetable or host plant which is now known to be, or hereafter may become a host plant or host fruit of any species of the fruit fly family *Trypetidæ* from any country, state or district where such species of *Trypetidæ* is known to exist and any such fruit, vegetable, or host plant, together with the container and packing, shall be refused entry and shall be immediately destroyed at the expense of the owner, owners or agents.

SEC. 6. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any peach, nectarine, or apricot tree or cuttings, grafts, scions, buds or pits of such trees, or any trees budded or grafted upon peach stock or roots that have been in a district where the disease known as "peach yellows" or the contagious disease known as "contagious peach rosette" are known to exist, and any such attempting to land or enter shall be refused entry and shall be destroyed or returned to the point of shipment at the option of the owner, owners or agent, and at his or their expense.

SEC. 7. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any injurious animals known as English or Australian wild rabbit, flying fox, mongoose or any other animal or animals detrimental to horticultural or agricultural interests.

SEC. 8. Any person, persons, firm or corporation violating any of the provisions of this act shall be guilty of a misdemeanor and shall be punished by imprisonment in the county jail for a period not exceeding six months, or by a fine not exceeding five hundred dollars, or by both such fine and imprisonment.

SEC. 9. It is hereby determined and declared that this act and each and all of the provisions thereof, constitute and is an urgency measure necessary for the immediate preservation of the public safety and health. The facts constituting such necessity are as follows: There now exists in various islands and territory in close proximity to the State of California dangerous and injurious fruit and plant diseases and insects and animals, and heretofore fruits, vegetables, plants, seeds and other articles of horticulture and agriculture from said islands and territory have been and now are being shipped and brought into the State of California, which are to a large extent infested and infected with dangerous and injurious fruit and plant diseases and insects, their eggs, larvæ and pupæ, and which if continued to be brought into the state will cause great danger to the public health, and will greatly damage the horticultural and agricultural interests of said state, and will also be detrimental to the public health, and this act is necessary to provide ample power to prevent the introduction of such insects and diseases and injurious animals into the state and to prevent the spread of such disease, insects and animals.

SEC. 10. That certain act entitled "An act for the protection of horticulture, and to prevent the introduction into this state of insects, or diseases, or animals, injurious to fruit or fruit trees, vines, bushes, or vegetables, and to provide for a quarantine for the enforcement of this act," approved March 11, 1899, is hereby repealed.

SEC. 11. This act, being an urgency measure as above set forth, shall take effect and be in full force immediately from and after its passage.

EXTRACTS FROM THE SANDERS BILL (see page 1650).

2. There is hereby created a board which shall be known as the "Horticultural Inspection Board" of (State), hereinafter called the Board, consisting of three (five) members, two (four) members of which shall be ex-officio members. The third (fifth) member shall be appointed by the Governor for a term of four years. Such third (fifth) member shall be a nursery man actively engaged in the growing of nursery stock. The members of said board shall serve without compensation, but shall receive their actual and necessary traveling expenses incurred in the discharge of their official duties within the provisions of (this act) (sections ——— to ——, inclusive). This board is hereby vested with all powers necessary to carry out the provisions of (this act) (sections —— to ——, inclusive.)

Appointment.

3. The Board shall appoint some person qualified by scientific training and practical experience to be state nursery (and orchard) inspector, hereinafter called the inspector, who shall strictly enforce the provisions of (this act) (sections —— to ——, inclusive) as a police regulation of the (state) (commonwealth) under the direction and control of the Board.

Appointment of deputies.

5. The Board is hereby authorized to appoint on the recommendation of the inspector (deputies) (county horticultural inspectors) (district horticultural inspectors) who shall strictly enforce the provisions of (this act) (sections —— to ——,

inclusive) under the direction of the inspector, and they are hereby endowed with the same police power as the state inspector, and shall be furnished with official badges or other insignia of authority, which shall be carried while on duty.

6. The Board (State Horticultural Commission) shall have the power to prescribe, modify and enforce such reasonable rules, regulations and orders as may be needed to carry out the provisions of this act, and may publish an annual report describing the various phases of the inspection work, or may publish such other information as may seem desirable concerning the inspection and such insects and diseases as are covered by (this act) (Sections —— to ——, inclusive). Such rules and regulations to be printed from time to time and furnished free to interested parties.

Inspector's duties and powers.

7. The inspector or his deputies shall at least once each year inspect all nurseries and other places in which nursery stock is kept for sale in the state. For this purpose such state inspector or his deputies shall have free access, within reasonable hours, to any field, orchard, garden, packing ground, building, cellar, freight, or express office, warehouse, car, vessel, or other place, which it may be necessary or desirable for him to enter in carrying out the provisions of this act. It shall be unlawful to deny such access to the inspector or his deputies or to hinder, thwart or defeat such inspection by misrepresentation or concealment of facts or conditions or otherwise.

8. The inspector or his deputies shall have the authority to inspect any orchard, fruit or garden plantation, park, cemetery, private premises, public place, and any place which might become infested or infected with dangerous or harmful insects or plant diseases. He shall also have the authority to inspect or reinspect at any time or place any nursery stock shipped in or into the state and to treat it as hereinafter provided.

Diseased plant material on premises.

9. The inspector with the approval of the Board (State Horticultural Commission) is hereby empowered to prohibit and prevent the removal or shipment or transportation of plant material and any other material from any private or public property, or property owned or controlled by the state, or any area of the state (commonwealth) which in his judgment contains dangerously infested or infected nursery stock or plant or other material of any kind for such periods and under such conditions as in his judgment seems necessary in order to prevent the further spread of the infestation or infection, giving such notice thereof as may be prescribed by the Board; and during the existence of such order no person shall remove or ship from such area any such material whatsoever, except by special permission or direction (certificate) of the inspector.

10. It shall be unlawful for any person in this state knowingly to permit any dangerous insect or plant disease to exist in or on his premises. It shall also be unlawful to sell or offer for sale any stock infested or infected with such insect or disease.

11. In case the inspector or his deputy shall find present on any nursery or dealer's premises or any packing ground or in any cellar or building used for storage or sale of nursery stock any injurious insect or plant disease, he shall notify the owner or person having charge of the premises in writing to that effect, and shall withhold his certificate hereinafter provided for, until the premises are freed from such injurious insect or plant disease, as hereinafter provided. It shall be unlawful for any person after receiving such notice to ship or deliver or cause to be shipped or delivered any nursery stock from such aforesaid premises.

12. (1) If the inspector or his deputy shall find on examination any nursery, orchard, small fruit plantation, park, cemetery, or any private or public premises infested with injurious insects or plant diseases, he shall notify the owner or person having charge of such premises to that effect, and the owner or person having charge of the premises shall within ten days after such notice cause the removal and destruction of such trees, plants, shrubs or other plant material if incapable of successful treatment; otherwise, cause them to be treated as the inspector may direct. No damages shall be awarded to the owner for the loss of infested or infected trees, plants shrubs or other plant material under this act.

(2) In case the owner or person in charge of such premises shall refuse or neglect to carry out the orders of the inspector within ten days after receiving written notice, the inspector may proceed to treat or destroy the infested or infected plants or plant material. The expense thereof shall be assessed collected and enforced as taxes are assessed collected and enforced against the premises upon which such expense was incurred. The amount of such expense when collected shall be paid to and become a part of the fund used to enforce the provisions of (this act) (sections —— to ——, inclusive).

Imported stock.

14. Every person receiving directly or indirectly any nursery stock from foreign countries shall notify the (state) (county) (district) inspector of the arrival of such shipment, the contents thereof and the name of the consignor; and shall hold such shipment unopened until duly inspected or released by the inspector. In case any infested or infected stock is discovered in such shipment, the shipment shall be subject to the provisions of (this act) (sections —— to ——, inclusive).

Nursery certificate.

15. (1) The inspector shall cause to be issued to owners of any nursery in the state after the stock has been officially inspected as previously provided, and found to be apparently free from injurious insects or plant diseases, a certificate setting forth the fact of such inspection and the number of acres or fraction thereof inspected. Said certificate shall be valid not to exceed one year from (month) 1st.

(2) It shall be unlawful for any person to sell, to offer for sale or to remove or ship from a nursery or other premises, any nursery stock unless such stock has been officially inspected and a certificate or permit has been granted by the inspector.

Dealer's certificate.

16. All dealers within the meaning of this act, located either within or without the state, engaged in selling nursery stock in this state or soliciting orders for nursery stock within this state, shall secure a dealer's certificate by furnishing a sworn affidavit that he will buy and sell only stock which has been duly inspected and certified by an official state inspector; and that he will maintain with the inspector a list of all sources from which he secures his stock.

Agent's certificate.

18. All agents within the meaning of this act selling nursery stock or soliciting orders for nursery stock for any nurseryman or dealer located within the state or outside the state, shall be required to secure and carry an agent's certificate bearing a copy of the certificate held by the principal. Said agent's certificate shall be issued only by the (State) inspector to agents authorised by their principal or upon request of their principal. Names and addresses of such agents shall not be divulged by the inspector or the board.

19. The inspector shall at any time have the power to revoke any certificate for sufficient cause, including any violation of (this act) (sections —— to ——, inclusive) or non-conformity with any rule or regulation promulgated under (this act) (sections —— to ——, inclusive).

INULA (ancient name). *Compósitæ.* Hardy herbaceous plants of the easiest culture and of rather coarse habit, with heads of yellow or orange, each 2 to 4 inches across, borne in summer.

Herbs, usually perennial, glandular, hairy: lvs. radical or alternate, entire or serrate: heads large, medium or small, solitary, corymbose, panicled or crowded at the crown; fls. tubular and ray, the rays yellow, rarely white; disk-fls. perfect, their tubular corollas 5-toothed: achenes 4–5-ribbed.—A genus of about 56 species, found in Eu., Asia and Afr. None of its near allies is cult.

There is such a great abundance of autumn-flowering yellow composites in the hardy border that only those inulas that bloom in early summer are particularly desirable. Elecampane, *I. Helenium*, is probably also cultivated for medicine. A preparation of the mucilaginous roots is common in drugstores. Inula flowers have as many as forty linear rays. The plants like a sunny position, grow vigorously in any garden soil, and are propagated by division or seed.

A. *Sts. panicled or corymbose.*

Helènium, Linn. ELECAMPANE. Fig. 1959. Tall, thick-stemmed: lvs. unequally dentate-serrate; root-lvs. elliptic-oblong, narrowed into a petiole; st.-lvs. half-clasping, cordate-oblong: outer involucral parts leafy, ovate. Wet, sandy and mountainous regions. Eu., N. Asia. Naturalized in Amer.—The roots are thick and carrot-like. For medicinal purposes, 2-year-old roots should be dug in Aug. If older, they are likely to be stringy and woody.

AA. *Sts. 1-fld., or with at most 2 or 3 heads.*

B. *Outer involucral parts linear and numerous.*

C. *Plants 2½ ft. tall or more.*

grandiflòra, Willd. Height 3–4 ft., the st. simple and hairy: lvs. elliptic-oblong, serrulate, all sessile; upper ones subcordate; lower ones 2–4 in. long: glands numerous: heads 3¼–4 in. across. Himalayas, Caucasus. G.F. 6:406.—Earliest blooming inula in cult. Bears orange-yellow fls. 5 in. across in June, and has bold but not coarse habit.

glandulòsa, Willd. Height 2½–4 ft.: lower lvs. oblong-spatulate, long-attenuate at the base, the uppermost oblong with a subcordate-decurrent base, all entire or very obsoletely denticulate: glands remote;

scale of involucre lance-shaped and hairy. Caucasus. B.R. 334. B.M. 1907. Gn. 22, p. 234; 25, p. 101; 49:6 and p. 7. J.H. III. 35:153; 63:139. R.H. 1881, p. 419. G.M. 33:541; 38:477. G. 5:337; 7:649, 651. Var. **laciniata,** Hort., seems to be a trade name for the fimbriate form figured in G.M. 46:625.—Keller says it has deep golden-yellow, fringed, half-drooping rays. Rays are commonly said to be entire, but B.M. 1907 shows 2 minute teeth, and in B.R. 334 the fringes are more than ¼in. long. This is said to be the only cult. species that does not seed freely. The Garden pictures an orange variety.

cc. *Plants 2 ft. or less tall.*

Hoòkeri, C. B. Clarke. Height 1–2 ft., usually very shaggy above: lvs. 3–5 in. long, sessile or narrowed into very short petioles, oblong-lanceolate, acute at the base, minutely toothed, glandular: heads 1½–2½ in. across; rays "pale yellow," according to Hooker. Himalayas. B.M. 6411 (rays pure yellow).—Fls.

1959. Inula Helenium. (×⅓)

orange-yellow, according to J. W. Manning. It is said to flower in Aug. and Sept., and has bright yellow fringed rays. However, in B.M. 6411 the rays have only 3 minute teeth.

británnica, Linn. A hairy perennial usually not over 18 in. high, with a simple st. and lanceolate slightly toothed lvs.: fls. lemon-yellow, the bracts linear and very numerous. June–Aug. Eu. and Asia.—Useful for its early bloom and small stature.

BB. *Outer involucral parts lanceolate and leafy.*

hírta, Linn. St. 12–15 in. high, simple: lvs. netted-veined, lanceolate or ovate-oblong, the lowest narrowed at the base, the others rounded at the base and half-clasping, all entire or finely ciliate. Eu., N. Asia.—Fls. July–Aug.

ensifòlia, Linn. (*I. bubònium,* Hort.). St. about 2 ft., simple: lvs. with numerous somewhat parallel nerves, narrowly linear-lanceolate: fls. large, yellow, the involucral parts appressed, not spreading. Eu., N. Asia. G.M. 41:559.—July, Aug. Rockery plant; blooms first year from seed if sown early.

Royleàna, DC. A striking, large-fld. elecampane with orange-yellow petals: st. unbranched, bearing numerous ovate, slightly toothed, hairy lvs. which are narrowed at the base into winged petioles: fls. very numerous in each head, showy; buds conspicuous, black. Himalayan region. F.S.R. 1:310. G.C. III. 38:264. Gn.W. 23:693. G. 30:117.—Suitable for somewhat protected places.

AAA. *Sts. racemosely clustered.*

racemòsa, Hook. f. A tall stout perennial, 1–5 ft., with a grooved st. and leathery lvs. 8–18 in. long: heads numerous, 1½–2 in. across, showy, the outer bracts with recurved tips. Himalayas.—Little known in Amer. and perhaps not hardy.

I. Óculus-Christi, Linn. Two ft.; an erect, somewhat branched, woolly perennial with oblong hairy lvs.: fls. yellow, the rays twice longer than the involucral bracts. Sold in England, but apparently unknown in Amer.

N. TAYLOR.†

IOCHRÒMA (Greek, *violet-colored*). *Solanàceæ.* Flowering shrubs cultivated outdoors in California and under glass in Europe.

In the wild, shrubs or small trees; spineless, glabrous or mostly stellate-tomentose: lvs. entire, often large: fls. purple, blue, scarlet, yellow or white, in clusters or on twin pedicels; corolla long-tubular or narrow-trumpet-shaped, with 5 short or very small lobes, the throat more or less closed by appendages or folds; stamens inserted in the tube, included or exserted; disk present or absent; ovary 2-celled: fr. a pulpy berry.—Species about 20, mostly in W. Trop. S. Amer.

A. *Fls. blue.*

lanceolàtum, Miers. Shrub, 4–8 ft. high, the young branches downy with stellate hairs: lvs. alternate, oval or elliptic-lanceolate, acute, entire, tapering below into a long petiole: umbels supra-axillary and terminal; fls. rich deep purple-blue; corolla-tube slightly curved, somewhat puberulent, the margin shortly unequally 5-lobed or -toothed and pubescent. Ecuador. B.M. 4338 and F.S. 4:309 (as *Chœnestes lanceolata*).—Seedlings are said to vary in shades of violet or purple.

tubulòsum, Benth. Shrub, 4–6 ft., the sts. and lvs. pubescent or hairy: lvs. stalked, ovate, attenuate at base and acute or somewhat abruptly acuminate at apex: fls. deep blue, as many as 20 sometimes hanging in a graceful cluster; corolla about 1½ in. long, tubular, the brief margin or limb 5-toothed. Colombia. B.R. 31:20. F.S. 1:131.

grandiflòrum, Benth. (*I. Warscewiczii,* Regel). Handsome shrub, with terete pubescent branches: lvs. broadly ovate, rounded at base and acuminate at apex, pubescent above and paler beneath: fls. in a simple peduncled terminal several-fld. pendulous cyme, large and rich purple; corolla funnelform, the tube long and pubescent, the throat flaring or campanulate and the large limb with 5 triangular spreading-recurved lobes; filaments included, glabrous. Ecuador. B.M. 5301. F.S. 11:1163. H.F. II. 5:102. Gt. 4:130.—The *I. purpureum* of trade-lists may belong here.

AA. *Fls. scarlet, orange-scarlet or yellow (to white in cult.).*

fuchsioìdes, Miers. Shrub, glabrous or nearly so: lvs. often clustered, obovate to oval or oblong, very obtuse, tapering at the base into a short petiole: fls. more or less clustered, orange-scarlet, drooping; corolla thrice exceeding the 5-toothed and bursting calyx, the tube long-cylindrical and nearly straight, the limb 5-angled and with intermediate teeth; filaments included, downy at the base. Peru. B.M. 4149 and F.S. 1:157 (both as *Lycium fuchsioides*).—A white-fld. form is also offered.

flàvum, André. Bushy shrub, 6 or 7 ft., the young growth glabrous: lvs. alternate and stalked, oval-lanceolate, short-pubescent beneath, attenuate at both ends: fls. pale yellow, in drooping axillary clusters, tubular, 1½ in. long, the border or limb short-toothed. Colombia. R.H. 1898:360.

coccíneum, Scheidw. Shrubby, the branches pubescent: lvs. stalked, oblong, undulate and somewhat repand, long-acuminate, hairy on nerves and veins: fls. in an umbel-like fascicle, drooping, scarlet; corolla long-tubular, about 2 in. long, with a narrow border or limb; calyx about ¼in. long, broadly short-toothed. Cent. Amer. F.S. 12:1261. L. H. B.

IÒNE (one of the nereids). *Orchidàceæ.* About a half-dozen pseudobulbous orchids of E. India, by some united with Bulbophyllum: lateral sepals usually connate and under the lip, the latter rather large, straight and rigid; pollinia 4, attached in pairs to 2 glands. *I. paleàcea,* Lindl. (*Bulbophýllum paleàceum,* Benth.), has drooping fls. about 1 in. long, many in erect spikes; sepals greenish with pink nerves; petals spreading, broadly oblong and 1–3-nerved; lip ovate-lanceolate: scape exceeding the lf., about 9 in. India. B.M. 6344. *I. siamênsis,* Rolfe. Pseudobulbs 1-lvd., 4-angled-ovoid: lvs. narrow-oblong, about 3 in. long: scapes nearly erect, slender, about 6 in. long, bearing a raceme about 2½ in. long that has 9–10 fls., which are about ⅓in. long, pale green with dull purple on lateral sepals and lip and with purple dots near margin of outer segms. Siam. Recent. *I. grandiflòra,* Rolfe. Pseudobulbs 1-lvd., ovoid: lvs. oblong, 2 in. or less long: scapes erect, 1-fld.; fl. dull lurid purple; sepals and petals oblong, acute; lip cordate-ovate, hirsute above, keeled beneath. Burma. Recent. L. H. B.

IONÍDIUM CONCOLOR: *Hybanthus.*

IONOPSÍDIUM (Greek, *violet-like*). *Cruciferæ.* One pretty, tufted little plant, growing 2 or 3 in. high and bearing numerous small 4-petaled, lilac fls. from spring to fall. It is a half-hardy perennial from Portugal and N. Afr., but is treated as an annual. It is desirable for edgings in moist shady places, and for rockeries; also as a pot subject in window-gardening. In rich garden soil the plants make numerous runners. The fls. are about ½in. across, 1 on each stalk. They open white and turn lilac. The plant has been advertised as the diamond flower. This plant is referred by some to Cochlearia, a genus whose limits are very uncertain.

acaûle, Reichb. (*Cochleària acaùlis,* Desf.). Lvs. ovate-rotund, heart-shaped at the base; petioles proportionately very long: pods subrotund, notched. B.R. 32:51. Gn. 71, p. 90; 72, p. 398.—Summer to winter.
WILHELM MILLER.

IONÓPSIS (Greek, *violet-like*). *Orchidàceæ.* A small group of epiphytic orchids, numbering about ten species, many of which can probably be reduced to varieties of a few species. Most of the species are insignificant, only one or two being cultivated.

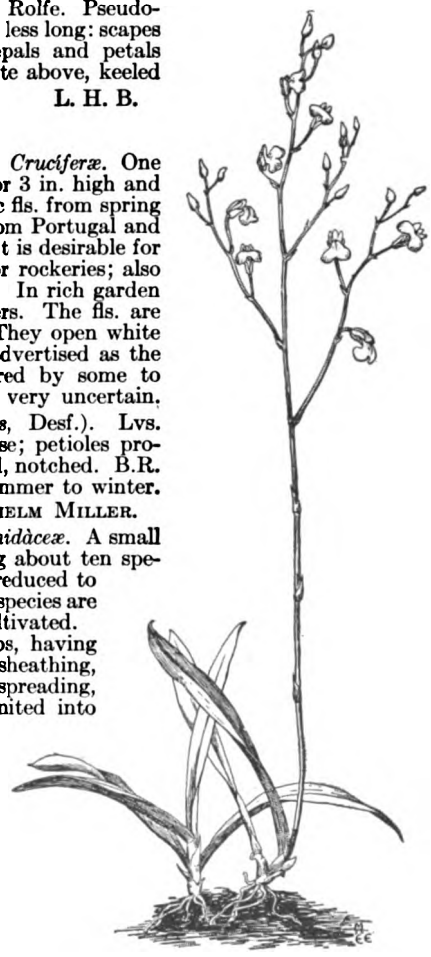
Tropical herbs without pseudobulbs, having very short sts., with few, narrow, sheathing, coriaceous lvs.: sepals subequal, erect, spreading, the dorsal one free, the lateral ones united into a short spur behind; petals like the dorsal sepals; labellum united to the base of the column, middle lobe large, expanded, 2–3 times as long as the sepals, 2-lobed; column short; pollinia 2; fls. small, in simple racemes or much-branched panicles. The fine specimen of *I. paniculata* figured in the Botanical Magazine has a panicle 10 in. long, 8½in. wide, with 5 branches, and about 80 fls., each ¾in. across and chiefly white, with violet markings near the center and a dash of yellow. In its native country it is said to remain in attractive condition from Sept. to May. The fls. are produced so freely and over so long a period that it is sometimes necessary to destroy the fl.-spikes, which are out of all proportion to the number of lvs. The plants succeed in the warm-house under the same treatment as rodriguezias or the more delicate oncidiums.

The best means of culture for the successful growing of these beautiful though delicate orchids is in shallow pans with plenty of small broken coal cinders for drainage, covered with the fine particles of fern root and chopped sphagnum gathered from the upland meadows. Plenty of heat and moisture during the growing season are essential. Rest them in winter at a temperature of 50° to 55° F. (Wm. Mathews.)

paniculàta, Lindl. Lvs. thick and channelled, linear-lanceolate, keeled, 2–3 in a cluster and about 6 in. long: panicle much branched and spreading, loaded with innumerable fls. of a delicate texture; sepals and petals very short, sharp-pointed, the petals wider; labellum very large, pubescent at base, with a 2-lobed rounded limb, which in some is almost entirely white, while in others it has a spot of purple or yellow on the disk. Winter. Brazil. B.M. 5541. F.S. 22:2333. A.F. 6:631. C.O. 1.—Very variable.

utricularioides, Lindl. Fig. 1960. Lvs. and general habit as in the last: sepals and petals bluntish; spur short; labellum almost twice as long as the petals; lobes subquadrate-rounded, white, streaked with red veins. Jamaica.

I. testiculàta, Lindl. Lvs. tufted, terete, acuminate: fls. whitish, small, numerous. Jamaica.
HEINRICH HASSELBRING.



1960. Ionopsis utricularioides. (×½)

IPECAC. The root of *Cephaëlis Ipecacuanha* (Vol. I, p. 714), a Brazilian plant not cultivated in North America. For wild or American ipecac, see *Gillenia stipulacea.*

IPOMŒA (according to Linnæus from *ips,* bindweed, and *homoios,* like, because of its resemblance to Convolvulus; but ips is a worm). Including *Batàtas, Operculìna,* and *Phárbitis. Convolvulàceæ.* MORNING-GLORY. MOONFLOWER. Annual or perennial herbs, mostly twining, rarely trees (G.F. 7:364) or shrubs, widely distributed in tropical and temperate regions. They are remarkable for easy culture, quick growth and beautiful flowers; hence the genus includes several of our most popular plants for covering verandas and screening unsightly objects.

The generic characters of Ipomœa are not clearly defined. It is distinguished from Convolvulus by having but 1 capitate or 2–3 globose stigmas, while Convolvulus has 2 linear or ovate stigmas. From Calonyction and Quamoclit it is distinguished by its funnelform corolla-tube and the stamens usually included. St. mostly slender, twining or climbing,

LVIII. One of the many beautiful garden irises.

sometimes prostrate, diffuse or erect: lvs. alternate, entire, lobed or parted, often varying greatly on the same plant: fls. usually showy, borne singly or in cymes on axillary peduncles; corolla funnelform, salverform or bell-shaped (in one species bag-shaped), the limb sometimes entire, but usually 5-angled or 5-lobed (a 5-petalled form of *I. purpurea* occurs as a monstrosity), red, purple, blue, white or yellow, in various shades and mixtures; calyx without the bracts at the base, which appear in some species of Convolvulus, but the outer sepals are commonly larger. The fls. of most species open in early morning and last but a few hours under bright sunlight, hence the popular name. A few open only at nightfall.—Over 400 species of which more than 200 occur in Trop. Amer., chiefly in Mex.

"The Japanese morning-glories," also called "Imperial" and "Emperor" morning-glories, were introduced to the American trade from Japan in 1895. They are probably selected strains of *I. hederacea*, although some botanists consider them to be of hybrid origin, possibly *I. hederacea* × *I. tricolor*. Maximowicz referred them to *I. hederacea*, and this appears to be the more reasonable disposition. The culture of the "asagoa" in Japan amounted to a popular craze about 1830, the equivalent of $14 to $18 sometimes being paid for a single seed of the rare sorts. With political disturbances came a decline of interest, but more recently the popular fancy for morning-glories has again revived. The Japanese gardeners grow their plants almost entirely in pots, and by constant attention have made them vary into many curious oddities in flower and foliage. Several finely illustrated books on the morning-glory alone are published in Japan. See also "Century Magazine," 55:281 (1897). The Japanese ipomeas are sold in this country mostly in strains, each package of seed giving flowers of many forms and colors. There are some inferior strains offered, and the flowers from these are often disappointing; yet as a class the Japanese morning-glories are the most gorgeous and versatile of garden ipomeas. If the seeds are notched they will generally give bloom in six weeks from sowing.

Morning-glories are among the least exacting of garden plants as regards soil and site. Most species love a strong soil and sunny site, with plenty of water; but they will make the best of much that is uncongenial. The seeds of the annual kinds may be sown directly out-of-doors, but are preferably started indoors, at least in the North. If the plants are allowed to become slightly pot-bound before being transplanted, they will come into bloom earlier. Germination may be hastened and also made more certain by filing a small notch in each seed, or by soaking the seeds in warm water about two hours. The "moonflower" and the "Japanese morning-glories" particularly are likely to germinate poorly unless these precautions are taken.

The perennial ipomeas are grown from seeds in some cases, but mostly from cuttings of well-ripened wood, layers, or division of the rootstocks. Some of the greenhouse species, notably *I. Horsfalliæ*, rarely produce seed and are rooted from stem-cuttings with great difficulty. These are often propagated successfully by grafting well-ripened shoots on pieces of their own roots, or the roots of *I. pandurata*. *I. ternata* roots from cuttings more readily, and *I. Learii* and *I. Jalapa* are easily propagated from cuttings.

The rapid growth and dense foliage of most garden ipomeas make them especially valuable for covering arbors, verandas, walls, and for screening unsightly objects. *I. purpurea*, *I. tricolor*, *I. hederacea* are the most popular annual species for this purpose; and *I. Learii*, *I. setosa* and *I. pandurata* are among the best perennials. In the South, the perennials may be carried through the winter outside by cutting off the stems and mulching the roots heavily in the fall; in the North the tubers should be taken up and wintered like dahlias, keeping them perfectly dry in a cool greenhouse or frost-proof cellar. *I. leptophylla* is valuable for very dry soils. *I. Bona-nox* (see *Calonyction aculeatum*) is worthy of a place in every garden.

The tender perennials are seen to advantage when trained to pillars, trellises, or along the roof of a greenhouse. Their roots should be given plenty of room to forage and their tops to spread. *I. Horsfalliæ* and its closely related species, *I. ternata*, are very satisfactory for this purpose. After flowering, the strong shoots should be cut back and the plant rested. Several species, particularly *I. Learii*, *I. tricolor* and *I. hederacea*, make excellent pot-plants if they are kept somewhat pot-bound to induce flowering. The roots of nearly all the perennial species are more or less purgative; particularly *I. Purga*, from which comes the jalap of commerce, *I. Jalapa* and *I. cathartica*. *I. Batatas* is the common sweet potato.

The trade names of ipomeas are endlessly mixed. Thus, *I. mexicana* of the catalogues may be *I. hederacea*, *I. digitata*, *I. Jalapa*, *I. Bona-nox*, *I. Learii* or *I. tricolor;* but is rarely the true *I. mexicana* of Gray. "Moonflower" is often applied indiscriminately to several species of Ipomœa, but it should be restricted to species of Calonyction. It is evident that most of the plants now sold as *I. grandiflora* are forms of *Calonyction aculeatum*. *I. hybrida* is a trade name for strains of *I. purpurea* and *I. tricolor*. The "tree ipomœa" is *I. fistulosa*. The "Japanese" or "Imperial" morning-glories may be referred to *I. hederacea*. Other popular catalogue names are: Double morning-glory is mostly *I. purpurea fl.-pl.;* Brazilian morning-glory is *I. setosa;* hardy or perennial moonflower is *I. pandurata;* Ipomœa, Heavenly Blue, is *I. tricolor*.

INDEX.

acetosæfolia, 8.
alba, 10, 18, 19.
angustifolia, 17.
Antillana, 28.
arborescens, 5.
atro-cærulea, 10.
atro-sanguinea, 10.
aurea, 21.
azurea, 10.
Batatas, 33.
Bona-nox, 30.
bonariensis, 25.
Briggsii, 19.
Carletonii, 1.
carminata, 10.
carnosa, 8.
chrysantha, 27.
chryseides, 27.
corymbosa, 28.
cymosa, 28.
dealbata, 12.
Dickensonii, 10.
digitata, 24.
dissecta, 23.
Ferrandiana, 13.
ficifolia, 25.
filicaulis, 17.
fistulosa, 4.
flore-pleno, 10.
foliis marmoratis, 13.
fuchsioides, 15.
Goodellii, 4.
grandiflora, 13, 30.
hederacea, 13.
heterophylla, 9.
hirsutula, 11.
Hookeri, 18.
Horsfalliæ, 19, 20.
Huberi, 10.
insignis, 24.
integrifolium, 15.
Jalapa, 16, 29, 32.
kermesina, 10.
latifolia, 30.
Learii, 12, 14.
leptophylla, 2.
limbata, 13.
Lindheimeri, 9.
Lindleyana, 9.
littoralis, 8.
longifolia, 1.
macrorhiza, 29.
maritima, 7.
marmorata, 13.
mexicana, 11.
Michauxii, 29.
microdactylum, 15.
mutabilis, 12.
Nil, 13.
palmata, 24.
pandurata, 31.
paniculata, 24.
Perringiana, 25.
Pes-capræ, 7.
Purga, 16.
purpurea, 10.
rosea, 10.
rubro-cærulea, 18.
sagittata, 26.
scabra, 13.
Sellowii, 25.
setosa, 22.
sidæfolia, 28.
sinitata, 23.
sinuata, 23.
speciosa, 26.
stans, 3.
stolonifera, 8.
ternata, 20.
texana, 4.
Thomsoniana, 20.
tricolor, 18.
Tuba, 30.
varia, 10.
ventricosa, 30.
violacea fl.-pl., 10.
violacea-striata, 10.
Wolcottiana, 6.

KEY TO THE SPECIES.

A. *Plants erect, stout, perennial, shrubby or tree-like.*
  B. *Sts. erect or ascending from a tuberous root.*
    C. *Corolla white or cream-colored: lvs. lanceolate* ..... **1. longifolia**
    CC. *Corolla purple.*
      D. *Lvs. linear* ..... **2. leptophylla**
      DD. *Lvs. hastate and toothed* ..... **3. stans**
  BB. *Sts. subshrubby, 4–10 ft. high: corolla pink-purple* ..... **4. fistulosa**
  BBB. *Sts. woody, erect: arborescent: corolla white.*
    C. *Foliage more or less densely pubescent; lvs. ovate, cordate* ..... **5. arborescens**
    CC. *Foliage glabrous; lvs. ovate-lanceolate, rounded or truncate at base..* **6. Wolcottiana**
AA. *Plants twining, climbing or prostrate.*

BB. *Sts. prostrate or creeping, not twining.*
C. *Lf.-blades suborbicular, obcordate or notched at apex: fls. blue or purple* ..... 7. **Pes-capræ**
CC. *Lf.-blades variously lobed or oblong-lanceolate: fls. cream-colored* .... 8. **stolonifera**
BB. *Sts. twining or climbing.*
C. *Sepals herbaceous, often elongated and hairy; ovary and caps. 3-celled, 6-seeded (Pharbitis).*
D. *Lvs. deeply 3–5-lobed* ..... 9. **Lindheimeri**
DD. *Lvs. entire or 3-lobed.*
E. *The sepals merely acute.*
F. *Corolla 1½–2-in. long: lvs. usually entire* ..... 10. **purpurea**
FF. *Corolla about 1 in. long: lvs. usually 3-lobed* ..... 11. **hirsutula**
EE. *The sepals attenuate or caudate-attenuate.*
F. *The lvs. silvery-canescent or silky: corolla purple* ..... 12. **mutabilis**
FF. *The lvs. hispid to glabrate, not canescent.*
G. *Tips of sepals linear-attenuate, hispid below, the tips spreading* ..... 13. **hederacea**
GG. *Tips of sepals long-acuminate, not spreading, appressed pubescent with silvery hairs* ..... 14. **Learii**
CC. *Sepals thick, rarely subherbaceous and then not elongated.*
D. *Corolla salverform; stamens slightly exserted: st. woody below (Exogonium).*
E. *The corolla scarlet, 1½ in. long: lvs. lobed or entire* ..... 15. **microdactylum**
EE. *The corolla blue or purple, 2½ to 3 in. long* ..... 16. **Purga**
DD. *Corolla not salverform; stamens rarely if ever exserted (Batatas and Operculina).*
E. *The plants annual: sts. glabrous.*
F. *Lvs. linear or lanceolate, subsessile: fls. small, white* ..... 17. **angustifolia**
FF. *Lvs. ovate-cordate: fls. large, red, blue, or purple* ..... 18. **tricolor**
EE. *The plants perennial, often with large fleshy or woody roots or rootstocks.*
F. *Lvs. divided to the petiole into 3–9 separate, stalked or sessile lfts.: peduncles equaling or shorter than the petioles.*
G. *Fls. red: lf.-segms. sessile, tapering to both ends, margin wavy* ..... 19. **Horsfalliæ**
GG. *Fls. white: lf.-segms. stalked, not tapering to the ends, margin not wavy* ..... 20. **ternata**
GGG. *Fls. yellow: lf.-segms. sessile, long-pointed* ..... 21. **aurea**
FF. *Lvs. deeply divided but not into separate lfts.*
G. *Pedicels thickened and fleshy; sepals accrescent in fr., setaceous; corolla subsalverform, purplish red* .. 22. **setosa**
GG. *Pedicels not thickened nor sepals accrescent.*
H. *Fls. white: segms. of lvs. much toothed or cut; petioles and sts. hispid* .. 23. **sinuata**
HH. *Fls. rose-purple: lvs. palmately 5–7-lobed to beyond the middle* ..... 24. **digitata**
FFF. *Lvs. entire, angulate or lobed, not divided.*
G. *Sts., lvs. and peduncles densely hairy: corolla funnelform, its lobes obtuse: lf.-lobes unequal, blunt* .... 25. **bonariensis**
GG. *Sts. and foliage not hairy.*
H. *The lvs. sagittate, short-petioled: fls. 2–3 in. long, purple* ..... 26. **sagittata**
HH. *The lvs. cordate.*
I. *Corolla small, ½–¾ in. wide.*
J. *Color of corolla yellow* .. 27. **chryseides**
JJ. *Color of corolla white: fls. in dense cymose clusters* ..... 28. **sidæfolia**
II. *Corolla large, 2–4 in. long.*
J. *Foliage whitish tomentulose: fls. cream-colored with a magenta throat* ..... 29. **macrorhiza**
JJ. *Foliage not whitish tomentulose.*
K. *Color of corolla white, 3–4 in. long: caps. large, 1 in. diam., operculate-dehiscent* ..... 30. **Tuba**
KK. *Color of corolla white with a magenta throat: foliage pubescent or glabrate; lvs. pale beneath* .... 31. **pandurata**
KKK. *Color of corolla pink, yellowish purple or purple.*
L. *Lvs. softly pubescent, plicate-veined: fls. pink or purplish* ..... 32. **Jalapa**
LL. *Lvs. glabrous, acute, cordate, hastate or variously lobed* .... 33. **Batatas**

1. **longifólia,** Benth. (*I. Cárletonii,* Holzin.). Sts. glabrous, erect or ascending from a large tuberous root: lvs. linear-lanceolate to oblong-lanceolate, nearly sessile: fls. large, 2–3 in. long, white. Prairies and plains, Okla. to Texas and Mex. and Ariz. Contr. Nat. Herb. 1:17.

2. **leptophýlla,** Torr. BUSH MOONFLOWER. St. 2–5 ft. high, with many slender, recurving branches: lvs. 2–4 in. long, entire: peduncle stout, 1–4-fld., usually

1961. Morning-glory, Ipomœa purpurea (×½)

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shorter than the lvs.; corolla about 3 in. across, funnelform, rose-pink, deepening to purple in the throat. Aug.–Oct. Dry plains, Neb. and Wyo., south to Texas and N. Mex. Plant World 7:5, 6.—This and the preceding species are adapted for very dry places because of the enormous tuberous rootstocks, which often weigh 100 pounds and extend into the subsoil for 4 ft. They sometimes thrive where no rain has fallen for 1–3 years. The plant is beautiful when in flower.

3. **stans,** Cav. A beautiful erect, branching shrub with a thickened woody root: sts. and foliage finely pubescent: lvs. nearly sessile, oblong, hastate and deeply toothed at the base: fls. solitary on axillary peduncles, pink or purple, 2–2½ in. long. Mex.—The best of the several species of Mexican bush moonflowers, none of which is hardy.

4. **fistulòsa,** Mart. (*I. texàna,* Coulter). St. 4–10 ft. high, subshrubby, branching, smooth or minutely pubescent: lvs. 4–6 in. long, thickish, entire or nearly so: peduncles 1–2 in. long, mostly shorter than the petioles, few- to many-fld.; corolla about 3 in. long, bell-shaped, pink-purple. July–Sept. Brazil; now escaped from gardens in Mex. and S. U. S.—It is known to the trade chiefly as var. **Goòdellii** (*I. Goòdellii,* Hort.). This variety has lavender-pink fls., with a darker throat, and is apparently more floriferous and desirable than the type. It produces seed sparingly, but is easily rooted from cuttings. In the S. it is hardy if the st. is cut down and the roots mulched: in the N., the roots must be brought indoors. Advertised as the "tree ipomœa."

5. **arboréscens,** Don. An erect, woody, tree-like plant, reaching 15–20 ft. height: twigs and foliage finely velvety-pubescent: lvs. ovate-cordate: sepals oval, obtuse, ¼in. long, pubescent within and without; fls. white, 2 in. long: seeds black with a long coma of white hairs on the dorsal angles. Mex. G.F. 7: 364.—Requires a dry cool air like most of the cacti and makes an interesting companion plant to them in a cactus-house.

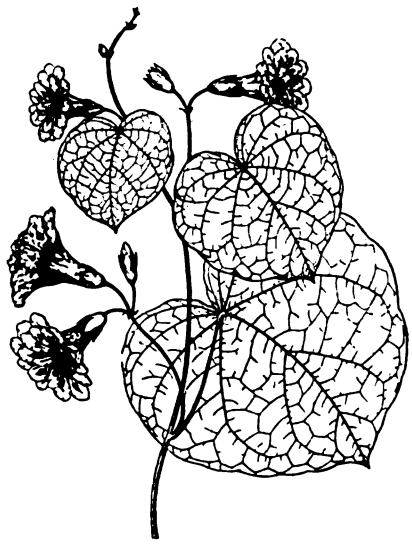
6. **Wolcottiàna,** Rose. Tree, 25–30 ft. high, often 1 ft. through, with slender, slightly drooping branches: lvs. ovate to ovate-lanceolate, 3–5 in. long, smooth: fls. numerous, in short racemes or corymbs; corolla about 2½ in. broad, white, broadly bell-shaped. Mex. G.F. 7:365.—Seeds do not germinate readily.

7. **Pes-càpræ,** Roth (*I. martìma,* R. Br.). St. creeping, seldom twining, 20–60 ft.: roots often 12 ft. long and 2 in. thick: lvs. 1–4 in. long, fleshy, roundish, often broader than long, with 2 glands at the base and prominently pinnate-veined: peduncles usually few-fld., equaling the petioles; corolla nearly 2 in. long, bell-shaped, margin scarcely lobed. Aug.–Oct. Trop. coasts of both hemispheres; drifting sands of coast, Ga. to Texas. B.R. 319.

8. **stolonífera,** Poir. (*I. carnòsa,* R. Br. *I. acetosæfòlia,* R. & S. *I. littoràlis,* Boiss. not Blume). Sts. glabrous, creeping and often rooting at the nodes: lvs. variously lobed or oblong-lanceolate, not cordate: fls. cream-colored, 1½ in. long. Circumtropical on sandy shores, S. C. to Fla. Cyrill, Pl. Rar. fasc. 1. pl. 5.

9. **Lindheimeri,** Gray (*I. heterophýlla,* Torr., not Ort.). Plant finely pubescent, hoary when young: lvs. deeply 5-cleft or 5-parted, all of the lobes or the 3 interior ones ovate to ovate-lanceolate, with a much contracted base: peduncle 1–2-fld.; corolla long-funnelform, about 3½ in. long, light blue. Rocky soils, W. Texas to N. Mex. Var. **Lindleyàna,** Hort. (*I. Lindleyàna,* Hort.), has smaller lvs., lighter colored fls., and is a more profuse bloomer. An improvement on the type, but more tender.

10. **purpùrea,** Roth (*Convólvulus màjus,* Hort. *Convólvulus purpùreus,* Linn.). TALL MORNING-GLORY. Fig. 1961. St. trailing or twining for 4–10 ft., branching from the base: peduncles slender, 1–5-fld., often longer than the petioles; corolla 1–2 in. long, light blue, purple, pink and diversely variegated. July–Sept. Trop. Amer. Escaped from gardens to waste places, Canada to Fla., west to Neb. and Texas, widely distributed in most tropical regions. B.M. 113, 1005, 1682. Gn. 21, p. 295; 27, p. 473.—One of the most popular of garden annuals. Some of its varieties resemble the entire-leaved forms of *I. hederacea,* but may be distinguished by their longer and more slender peduncles, umbellate pedicels, and oblong-acute sepals without the long tip usually found on *I. hederacea.* Seeds ripen freely on cult. varieties and may be gathered for future sowings. Among the host of garden forms are: **álba,** white; **atro-cærùlea,** dark blue; **atro-sanguínea,** dark purple; **azùrea,** sky-blue; **carminàta,** light crimson; **Díckensonii** (*Phárbitis hispida* var. *Dickensonii*), azure-blue; **Hùberi** (*I. Hùberi* var. *variegàta,* Hort.). Lvs. marked with silvery white, fls. variously colored and margined with white; **kermesìna** (*I. kermesìna*), scarlet; **rósea,** blush-rose; **vària,** a trade name for packages containing a mixture of many kinds; **violàcea-striàta,** violet-purple. There are several double forms of *I. purpurea.* Var. **flóre-plèno,** Fig. 1962, has very large lvs.: fls. appearing much later than single varieties, semi- or much-doubled, bluish white streaked with light blue or pink. Intro. 1892. Said to be very floriferous and a good pot-plant. G.F. 5:593 (adapted in Fig. 1962). A.G. 14:246. Var. **violàcea fl.-pl.,** Hort., is entirely distinct from the preceding. Gt. 47, p. 133.



1962. Ipomœa purpurea var. flore-pleno.

11. **hirsùtula,** Jacq. (*Phárbitis diversifòlia,* Lindl. *I. mexicàna,* Gray). Like *I. hederacea,* but young lvs. entire or slightly angulate, becoming deeply 3-lobed and cordate, as in *I. hederacea,* the middle lobe broadest: peduncles as long or longer than petioles; corolla 1 in. wide, violet-purple, sometimes with crimson plaits; sepals merely acute, not attenuate and recurved as in *I. hederacea.* B.R. 1988. B.M. 4289.—The plants in the trade as *I. mexicana* are mostly *I. hederacea, I. digitata* and *Calonyction aculeatum. I. mexicana vera,* Hort., *I. mexicana grandiflora alba,* Hort., and *I. mexicana grandiflora hybrida,* Hort., are *Calonyction aculeatum* or *I. grandiflora.*

12. **mutábilis,** Lindl. (*I. dealbàta,* Hemsl. *I. Leàrii,* Meissn. not Paxt.). Perennial from a woody root: sts. densely and softly pubescent: lvs. orbicular-ovate, entire or 3-lobed, appressed silky-pubescent above, silvery canescent beneath: fls. 2–3 in. long, blue or purple with a white tube or throat. Mex. B.R. 39.—One of the most showy and ornamental species of the Pharbitis group.

13. **hederàcea,** Jacq. (*I. Nil,* Roth. *I. scàbra,* Forsk. and Hort.). St. twining or climbing, 2–8 ft.: lvs.

2–5 in. long, ovate-cordate, the lobes ovate to ovate-lanceolate, entire, or the lateral lobes repand or denticulate; the middle lobe narrowed at the base: peduncle 1–3-fld., mostly shorter than the petiole; corolla funnelform, the tube usually white, the limb light blue, purple or rose, and in various combinations of these colors; sepals hairy, lanceolate, with long and often recurved tips. July–Oct. Widely naturalized from Trop. Amer. in fields and waste places, Pa. to Fla., west to Neb. and Mex. Perhaps native in the South. B.R. 85 and 276 (as *I. cærulea*). B.M. 188 (as *Convolvulus Nil*). Gn. 27, p. 473.—This species shows great variation in the form of its lvs., both on the same plant and on different plants. In some forms formerly known as *I. Nil*, the lvs. are nearly entire; in others they are very deeply lobed. Next to *I. purpurea*, this is now the most popular morning-glory in cult., and the intro. of the improved Japanese strains will extend its usefulness. Before the appearance of these oriental varieties in occidental gardens, the species had already varied into many distinct horticultural varieties; as var. **limbàta,** (*I. limbàta*, Hort.), with the corolla violet-purple, edged with white. B.M. 5720 (as *Pharbitis Nil*). Gn. 29, p. 32. Var. **marmoràta cœléstina,** large fls., marbled and striped with light blue. Gt. 44, p. 592. Var. **marmoràta rôsea,** fls. marbled with rose. Gt. 44, p. 76. Var. **fôliis marmoràtis,** lvs. marked with yellow, limb of corolla rose-color. Var. **grandiflôra,** large blue fls. Var. **Ferrandiàna,** similar to var. *grandiflora*. Aside from these strains, the following named varieties of Japanese ipomœas are offered: Antigone, lvs. variegated: fls. blue, with pink throat. Aglaia, lvs. variegated: fls. crimson, with white throat. Aseria, fls. dull copper-red. Ceres, like Aglaia, but fls. edged with white. Euphrosyne, lvs. variegated: fls. pure white, with pink throat. Princess, fls. spotted with carmine. Gt. 47, p. 133. A form with foliage dotted with white is shown in I.H. 43, p. 75. The various strains give fls. which are diversely scalloped, ruffled, fringed, double, and show a wonderful range of coloring.

14. **Leàrii,** Paxt. BLUE DAWN-FLOWER. St. a very rapid grower, often 30–40 ft. long, somewhat shrubby at the base: lvs. 3–6 in. long, cordate, acute, mostly entire or slightly 3-lobed, variable: fls. borne in clusters of 12–30, opening in succession; corolla 4–5 in. broad, bell-shaped, deep lilac, sometimes dark purple with five lighter plaits. Very beautiful. Aug.–Oct. Tropics of both hemispheres; widespread. B.M. 3928 (as *Pharbitis Leari*). B.R. 27:56 (as *Pharbitis Leari*).—A magnificent species for the warmhouse, but not usually satisfactory outside, at least in the N. One plant is on record as producing 60,000 fls. at the rate of 300 a day. When grown in the open the fls. are likely to be an unattractive coppery purple. Thoroughly naturalized in S. Calif., and a most useful plant for covering waste places, enbankments, and the like.

15. **microdáctylum,** Griseb. A glabrous, woody, perennial twining vine, several feet in height, the sts. often covered with rough corky projections: root large and woody: lvs. 3–5-lobed or sub-entire, thick: fls. scarlet, sub-salverform, about 1½ in. long, the limb as broad and slightly 5-lobed; stamens slightly exserted. Fla. Keys and Cuba.—This is often mistaken for **I. fuchsioides,** Griseb., a rare and little-known Cuban species, not found on the Fla. Keys and probably not in cult. Var. **integrifôlium,** House. Lvs. entire, oblong-ovate, subcordate or obtuse at the base. Commoner than the species. Intermediate lf.-forms are often found on the same plant.

16. **Púrga,** Hayne (*I. Jalápa*, Nutt. & Coxe, not Pursh). Lvs. sagittate-cordate, smooth: peduncles generally 1-fld., longer than the petioles; fls. rose-purple; corolla long-tubular, with a flat limb. Sept., Oct. Trop. Amer. B.R. 33:49 (as *Exogonium Purga*).—The "Jalap" of commerce is an active purgative made by grinding to a powder dried slices of the tuberous roots of this species. It was principally collected near Xalapa, Mex., of which Jalap is a corruption.

17. **angustifôlia,** Jacq. (*I. filicaùlis*, Blume). St. prostrate, trailing or rarely climbing, much-branched: lvs. 1–3 in. long, less than 1 in. wide, glabrous: peduncles exceeding the petioles, bearing 1–2 small, bell-shaped fls., which are yellowish white with a purple eye. Aug., Sept. Widely distributed in Trop. Asia, Afr. and Amer. B.M. 5426. B.R. 317 (as *I. denticulata*).—Sometimes grown in the warmhouse, but there is hardly enough foliage to set off the pretty dark-eyed fls.

18. **tricolor,** Cav. (*I. rùbro-cærùlea*, Hook. *I. Hoòkeri*, Don and Hort.). St. tinged with purple, branched, 10–20 ft. high: lvs membranaceous, much-veined, short-acuminate: peduncle hollow and wand-like, longer than petioles, 3–4-fld.; fls. 3–4 in. wide, the tube white and limb red before expanding, at length purple or china-blue. Aug.–Oct. Mex. R.H. 1855:441 (as *Pharbitis rubro-cærulea*). B.M. 3297. P.M. 3:99. Gn. 27:72. G.C.III.53: 104.—One of the most beautiful of annual climbers. The fls. are often dashed, blotched and shaded with rose, or are entirely rose. It is likely to run to vine when out-of-doors unless the roots are confined in a box or pot to induce early flowering. It makes an excellent pot-plant for the greenhouse. Var. Heavenly Blue, from Calif., proves to be a blue form of *I. tricolor*, which is especially valuable for cut-fls. Var. **álba,** Hort., has pure white fls.

1963. Ipomœa digitata. (×⅛)

19. **Hórsfalliæ,** Hook. Fls. many, in a 2-branched cyme; corolla bell-shaped, the limb of 5 broad, rounded lobes, very showy. Cosmopolitan tropics. B.M. 3315. P.M. 3:50. F.S. 16:1647.—Perhaps the most popular ipomœa for winter-flowering in a warmhouse. If well treated it will climb 20–30 ft., and will bear hundreds of fls. each day in early winter. May also be grown out-of-doors, but it will not come into bloom till late fall unless the roots are cramped. Var. **álba,** Hort.,

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is *I. ternata;* Lady Slade has pale rose fls.; var. **Briggsii,** (*I. Briggsii*, Hort.), or Lady Briggs, is generally considered better than the type for most purposes. It is a freer grower and bloomer, the fls. are a rich magenta-crimson, and it roots from cuttings much more readily than *I. Horsfalliæ*. This variety makes a fine plant in a 10-in. pot. G.M. 37:49. Var. *Thómpsonii*, or *I. Thomsoniàna*, Hort., is *I. ternata*.

20. **ternàta,** Jacq. (*I. Hórsfalliæ* var. *álba*, Hort. *I. Hórsfalliæ* var. *Thomsoniàna*, Hort. *I. Thomsoniàna*, Mast.). St. somewhat woody at base: lvs. usually 3-parted, the segms. elliptic or elliptic-oblong, fleshy, smooth: fls. trumpet-shaped, about 2 in. across. Otherwise like *I. Horsfalliæ*, of which it is often considered a variety. Probably from W. Indies. G.C. II. 20:817. F. 1884, p. 118.—Not considered quite so effective for greenhouse cult. as *I. Horsfalliæ*.

21. **aùrea,** Kellogg (*Operculìna aùrea*, House). A slender twining vine, woody below, with very large, white, tuberous roots: lvs. digitately 5-lobed: fls. 2–4 in. across, funnelform, with a widely expanded limb, golden yellow: the rhombic, entire, sub-repand lfts. often deciduous, as are the branches. Lower Calif.

22. **setòsa,** Ker. Brazilian Morning-Glory. Plant very vigorous, branching, covered with stiff purplish hairs: lvs. 3–10 in. wide, cordate, angular or 3-lobed, the middle lobe abruptly contracted below into a narrow neck: peduncles many-fld., longer than the petioles; fls. 2–4 in. wide, salverform, rose-purple. Aug.–Oct. Brazil. B.R. 335.—An excellent free-growing climber for covering arbors, and especially valuable for making a dense screen because of its very leafy habit. In the latitude of New York seeds sown in the open will give flowering plants in late August. It may also be treated as a warmhouse deciduous twiner. Var. Northern Light is said to be a cross with *Calonyction aculeatum*. Plant unusually vigorous, often growing 40–50 ft.: fls. lavender-pink.

23. **sinuàta,** Ort. (*I. dissécta*, Pursh, not Willd. *I. sinitàta*, Hort.). St. somewhat woody at base, covered with long yellowish hairs: lvs. smooth or nearly so, palmately 7-parted, the divisions lanceolate or narrowly oblong, more or less sinuately cut and toothed: peduncles 1–2-fld., longer than the petioles; fls. 1–2 in. wide, bell-shaped, white with purple center; calyx as long as the corolla-tube. June–Sept. Trop. Amer., and near the coast from Ga. to Texas.—In Texas it expands only 2–3 hours at midday, and is there called the "noon-flower." It may be treated as a coolhouse evergreen, and is worth growing for its delicate foliage alone. In the N. the tubers must be wintered in a cellar.

24. **digitàta,** Linn. (*I. paniculàta*, R. Br. *I. palmàta*, Hort., not Forsk.). Fig. 1963. St. trailing or climbing, 20–40 ft.: lvs. 3–7 in. wide, 5–7-parted, the segms. elliptic, sometimes spatulate, entire: fls. numerous, in a 2-branched cyme; corolla 1½–3 in. wide, broadly bell-shaped, 5-lobed, pinkish purple or pink: seeds with a dense tuft of dirty white wool springing from the apex. July–Sept. Tropics of both hemispheres. R.H. 1853:381. B.R. 62; 333 (as *I. platensis*). B.M. 3685 (as *I. platensis*). Gng. 2:311.—One of the best tuberous-rooted ipomœas for the garden or warmhouse. In the N. it may be used with fine effect if grown in a tub and trained to an adjacent pillar or trellis, the vine being cut off before frost and the tub stored. Farther south the tubers may be planted directly in the open, and will give a profusion of bloom nearly all summer. Var. **insignis,** Hort. (*I. insignis*, Ker). Lvs. not palmately divided, nearly entire or lobed, the under surface sometimes purplish. B.M. 1790. B.R. 75.—There are few plants of var. *insignis* in cult.

25. **bonariénsis,** Hook. (*I. ficifòlia*, Lindl. *I. Perringiàna*, Damm. *I. Séllowii*, Penny). St. branching, tinged with purple and covered with short stellate hairs: lvs. deeply cordate, 3–5-lobed, the middle lobe longest: peduncles several-fld., longer than the petioles; fls. 1½–2 in. wide, violet to lilac, the limb spreading into 5 crenate lobes. Aug.–Oct. Trop. Amer. and Afr. B.M. 3665. B.R. 27:13. P.M. 9:25. Gt. 47:1446.—Here belongs *I. Sellowii*, Penny, and probably Hort., not *I. Selloi*, Mart., which is a distinct species.

26. **sagittàta,** Lam. (*I. speciòsa*, Hallier, not Pers.). Sts. twining from a perennial root, slender and glabrous: lvs. strongly sagittate, short-petioled: fls. slender, about 3 in. long, purple. Marshes and fields, N. C. to Mex. and W. Indies.

27. **chrysèides,** Ker. St. slightly woody, much twining, smooth or branches slightly hairy: lvs. 1–2 in. long, ovate-cordate to sub-hastate, acute, entire or toothed, 3-angled, 3-lobed and repand: peduncles 1–7-fld., longer than the petioles; corolla ½–¾in. wide, funnel-shaped. July–Oct. Trop. Asia and Afr. B.R. 270.—It can be grown out-of-doors, but is tardy in blooming. Best treated as a warmhouse evergreen climber. *I. chryseides* is advertised abroad. *I. chrysántha*, Hort., described in American catalogues as having rich, glossy foliage and golden yellow fls., may belong here.

28. **sidæfòlia,** Choisy (*I. corymbòsa*, Don. *I. cymòsa*, Lindl. *I. antillàna*, Millsp. *Turbìna corymbòsa*, Raf.). A slender, climbing perennial vine, woody below: lvs. ovate, cordate, small or medium-sized: fls. borne in large cymose clusters on elongated branching peduncles; corolla white, 1½ in. long and broad; sepals somewhat wing-like in fr.: caps. turbinate, usually 1-seeded. Fla., W. Indies, and Trop. Amer.

29. **macrorhìza,** Michx. (*I. Michàuxii*, Sweet. *I. Jalápa*, Pursh, in Bot. Mag. 1813, not Pursh's description, 1814). Sts. perennial from a thickened woody root, trailing or climbing 6–8 ft. high, springing from an oblong root weighing 4–30 pounds: foliage whitish with a soft tomentulose pubescence; lvs. entire, repand, or lobed, 3–5 in. long, ovate-cordate, membranaceous, veiny: peduncles 1–5-fld.; sepals very unequal, the inner ones ½in. long and twice as long as the outer ones; fls. about 3 in. long, cream-colored, with a magenta throat. S. C. to Fla. and Mex. B.R. 342.—A very ornamental warmhouse climber and valuable for the garden if the tubers are started in the greenhouse before being set out; otherwise the plant seldom blooms much before frost. The "Jalap" of commerce does not come from this plant, but from *I. Purga*. The roots of *I. macrorhiza* are but slightly purgative.

30. **Tùba,** Schlecht. (*I. latifòlia*, R. & S. *I. ventricòsa*, Don. *I. grandiflòra*, Lam. *Calonyction grandiflòrum*, Choisy). A stout, twining, perennial, woody vine: foliage glabrous or nearly so; lvs. ovate, cordate, 5–10 in. broad, thickish in texture: fls. white, funnelform, about 4 in. long: caps. large, 1 in. diam. with an operculate dehiscence. Amer. Trop.—Some of the inferior strains passing as *I. Bona-nox* and its synonyms belong here. Not a proliferous flowerer, and in cult. rarely successful.

31. **panduràta,** G. F. W. Mey. Man-of-the-Earth. Wild Potato-vine. St. 2–12 ft. long: root very long and large (10–20 pounds): lvs. 2–4 in. long, long-petioled, usually cordate and entire, occasionally angulate, fiddle-shape or hastately 3-lobed: peduncles 1–5-fld., commonly a little longer than the petioles; corolla 2–4 in. wide, broadly funnelform with pointed lobes, white with a dark purple throat. May–Sept. Dry soils, Canada to Fla., west to Ont. and Texas. A.G. 12:637. R.H. 1893:574. B.M. 1603 (as *Convolvulus candicans*), 1939, and Gn. 27, p. 373 (both as *C. panduratus*). B.R. 588.—In some places this species is a very troublesome weed, which is almost impossible to exterminate because of its long tuberous roots.

It can easily be kept within bounds in the garden with a little care, and makes a very desirable plant for covering an old dead stump or back fence. The chief merit of *I. pandurata* as a garden plant is its hardiness; hence it is often sold as the "hardy" or "perennial moonflower." If well mulched the roots will stand 26° below zero. There is a double-fld. form. It is sometimes escaped in cult. grounds.

32. **Jalápa,** Lindl. (*Batàtas Jalápa,* Choisy). A slender, glabrous, twining vine from a large woody root: lvs. triangular-ovate, entire or 3-lobed, plicate-veined: peduncles usually very short, 1-fld.; sepals sub-equal, broadly ovate, obtuse, ¼in. long; fls. slender funnelform, 2–2½ in. long, pink or purple. A Mexican species, the roots of which possess purgative powers equal to those of *I. Purga.* L.B.C. 6:518.—The names of this and *I. macrorhiza* have been confused from the fact that this plant, figured by Lindley in 1813 (B.M. 1572) as *Convolvulus Jalapa* (*I. Jalapa,* Pursh, as synonym) is not the Carolinian plant described by Pursh under that name in 1814. The plant described by Pursh as *I. Jalapa* is the *I. macrorhiza* of Michaux.

33. **Batàtas,** Poir. (*Batàtas édulis,* Choisy). SWEET POTATO. Lvs. ovate-cordate, usually angular or lobed, variable, petioled: peduncles equaling or exceeding the petioles, several-fld.; corolla 1–2 in. wide. Origin probably from *I. fastigiata* of Trop. Amer. (*I. platanifolia,* R. & S.).—Largely cult. in many varieties for its edible tubers. See *Sweet Potato.*

Several species of slight ornamental value occur in the southern states, and are sometimes seen in cult. *I. desertòrum,* House. Resembling I. hederacea but rough-pubescent and adapted to drier situations. Ariz.—*I. lacunòsa,* Linn. Annual with small white fls., often with a pink limb. Pa. to S. C., Ill. and Texas.—*I. polyánthes,* R. & S. (I. umbellata, Mey.). Small yellow fls. in umbels. Fla. and Trop. Amer.—*I. trichocárpa,* Ell. S. C. to Fla., Kans. and Mex.—*I. triloba,* Linn. Pink or purple corolla ¾in. long.: lvs. 3-lobed. Fla., Ariz. and Trop. Amer.

The two following species of recent intro. are as yet not common in the trade: *I. Macalùsoi,* Mattei. Slightly pubescent, woody sts.: lvs. ovate-orbicular, abruptly acute and mucronate, deeply cordate; petioles long, somewhat villous: fls. axillary, in subsessile cymes; corolla large, campanulate, orange-colored, margined with red. Native of Italian Somaliland.—*I. Mahònii,* C. H. Wright. An erect shrub with oblong lvs. about 1¾ in. long and 1 in. broad, obtuse at both ends, entire: petioles ¾in. long: corolla-tube deep reddish purple, paler above, the limb white or slightly suffused with pink, over 3 in. broad. Native of Uganda.

See Quamoclit for *Ipomœa Quamoclit, I. coccinea, I. vitifolia,* and *I. hederæfolia.* See Calonyction for *I. Bona-nox* and *I. tastense. Ipomœa Howardii,* P. D. Barnhart, Pacific Garden 4: No. 9, p. 5, Aug. 1911=Quamoclit grandiflora.

H. D. HOUSE.†

IPOMÓPSIS: *Gilia.*

ÍPSEA (fancied resemblance to *ips,* a cynip insect or a worm). *Orchidàceæ.* Two or 3 terrestrial E. Indian pseudobulbous orchids, allied to Pachystoma, with which it has been united: lvs. long, narrow and plicate: scape sheathed; fls. few, large, highly colored.

I. speciòsa, Lindl. (*Pachýstoma speciòsum,* Reichb.). Deciduous, tuberous-rooted, with erect scapes to 18 in. high: lvs. 5–8, long-petioled, 6–10 in. long: fls. several, bright yellow, fragrant, 2–3 in. diam., the lip oblong, with side lobes triangular and middle lobe obovate: pseudobulbs tufted. Ceylon. B.M. 5701. G. 26:189. —Blooms in winter. To be potted in fibrous loam, peat and leaf-mold, and rested after growth. L. H. B.

IRESÌNE (Greek name for a harvest garland wound with wool: the flowers and seeds of these plants are woolly). *Amarantàceæ.* ACHYRANTHES. Ornamental-leaved bedding plants.

Low, spreading, climbing or erect herbs or subshrubs: lvs. stalked, opposite, the margins not toothed in the domestic species: fls. very small, bracteate, in axillary or terminal panicles, perfect or imperfect (plants sometimes dioecious), the perianth of one series terete, 5-parted, with ovate-oblong segms.; stamens 5; style short or none, the stigmas 2 or 3: fr. a utriculus.—Species 20–25 in Trop. and Subtrop. Amer. Two or 3 species are in common cult. as bedding-plants, because of their highly colored lvs. and sts. The first of these to be intro. was described before the fls. were known and it was referred to Achyranthes (*A. Verschaffeltii*), but in that genus the anthers are 2-loculed, whereas in Iresine they are 1-loculed. To gardeners they are still known as Achyranthes.

1964. Iresine Lindenii. (×½)

Because of ease of propagation, ability to withstand sun and shearing, and the bright colors, the iresines are amongst the most popular bedding-plants. Few plants are easier to grow. Stock plants are kept over winter in a cool temperature (as in a carnation house), and in February and March they are given more heat and moisture, and cut back, to get cutting wood. Cuttings root quickly in any good cutting-bed. For mass bedding, plants are usually set 6 to 10 inches apart. They will not withstand frost.

Hérbstii, Hook. f. (*Achyránthes Verschafféltii,* Lem.). Lvs. broadly ovate or orbicular, obtuse and notched at the apex, purple-red, with prominent arched veins, or in the commoner variety green or green-red with yellow veins (var. *aùreo-reticulàta*). S. Amer. B.M. 5499. H.F. II. 7:103. This was described and figured in Aug., 1864, by Lemaire as *Achyranthes* (?) *Verschaffeltii* (I. H. 11:409), and later by Van Houtte as *Iresine Verschaffeltii* (F. S. 15:1601). In July, 1864, however, Hooker had published it as *Iresine Herbstii,* in honor of Mr. Herbst, of the Kew Nursery, who intro. it from the River Platte. There are horticultural varieties with Latin names. *I. Wállisii,* Ort., is a small form, with numerous small roundish lvs., which are bronze-red or dark red above and dark blood-red beneath. *I. brilliantíssima,* has rich crimson color.

Líndenii, Van Houtte (*Achyránthes acumináta,* and *I. acumináta,* Hort.). Fig. 1964. Lvs. ovate-acuminate or lance-ovate, with less arching or curving veins, in the original form rich, deep blood-red, but in some garden forms with light-banded veins. Ecuador. F.S. 17:1737. G.Z. 13:32.—More pyramidal in habit than the other species, and now more common. To this species evidently belong the garden forms known as *I. Emersonii, I. Collensii* and *I. formosa.*

I. Biemuèlleri, Voss (Achyranthes Biemuelleri, Haage & Schmidt), is probably a garden form of one of the above. It is a compact, dwarf grower, withstanding severe cutting: lvs. and twigs rose-carmine.

L. H. B.

IRIÁRTEA (after Bernard Iriarte). *Palmàceæ.* Tall spineless palms, with cylindrical or swollen stems supported on a pyramid of exposed roots.

Leaves few, unequally pinnate; lfts. equilateral, cuneate, entire or erose, plicate; petiole channelled; sheath cylindrical: fls. small: fr. 1–2 in. long: stigmas eccentric or lateral in fr. This palm is separated from Ceroxylon by the cuneate lfts.—Species 10. Trop. S. Amer. *I. Bungerothii* was advertised in 1895 as Triartea, which was presumably a typographical error for Iriartea. This is a horticultural name for *I. exorrhiza,*

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Mart., but the plant is in cultivation under the former name.

exorrhiza, Mart. (*I. Bungeròthii*, Hort.). Trunk about 35 ft. tall, crowned by a congested cluster of 10–20 showy lvs., each bearing 15–20 pairs of lfts., the latter about 20 in. long and 1½ wide: spadices 1–4, appearing between the lvs.; fls. yellow: fr. olive-green, reticulate. Trop. S. Amer.—Doubtfully in cult. at this time (1913) in Amer. N. TAYLOR.†

ÌRIS (Greek, *rainbow*). *Iridàceæ*. Plates LVIII, LIX. Showy and interesting flowers for outdoor bloom, widely known and planted; perennials with rhizomes or bulb-like root-stocks, mostly narrow long leaves, and commonly erect habit; includes the blue flag and fleur-de-lis.

Herbs with linear or ensiform equitant lvs.: st. simple or branched: fls. of 6 segms., the 3 outer reflexed, and the 3 inner usually smaller and erect, always narrowed to a distinct claw, 1 to many in terminal heads, from spathes which are formed of the upper bract-like lvs.; spathe stalked or sessile; style divided into 3 petal-like branches, which are bifid or crested at the tip; stigmatic surface immediately below the crests; ovary sessile or pedicelled, within the spathe.—Distinguished from the other members of the tribe except Hermodactylus and Moræa by the 2-winged style-branches, from Hermodactylus by the 3-celled caps., and from Moræa by the more or less connate perianth-segms. For monographs of the genus, see Baker's Irideæ, 1888, Lynch, The Book of the Iris, 1904, and the fine monograph of Dykes, The Genus Iris, 1913. The number of species of Iris recognized by different monographers ranges between 140 and 170. The synonomy includes something over 700 names. The extensive synonomy is an indication of the great variability and wide distribution of the genus. In general the irises are natives of the North Temperate Zone, but the different subgenera differ much in their distribution. The distribution of some of the subgenera is coextensive with that of the genus, while others are restricted to limited regions. The subgenus Apogon is the largest and also the most widely distributed section of the genus. Its representatives are found throughout temperate N. Amer., Eu., Asia and N. Afr. They extend from Alaska, Labrador and Kamtchatka in the north to Fla., Algiers and Honkong in the south. The members of the subgenus Pogoniris, which is the second largest and horticulturally the most important section, are found in Cent. and S. Eu. and N. Afr. and thence eastward to China and N. W. India. No members of this subgenus are indigenous to Amer. The small subgenus Evansia comprises a few species of crested irises which, with the exception of the two closely related American forms, *I. cristata* and *I. lacustris*, occur only in Japan and E. China. The American species differ widely from the far eastern ones in the absence of an evident stem. The subgenus Oncocyclus is a small section whose members are restricted to a limited region in Asia Minor, Syria, and Persia. Farther to the east, in Turkestan, the Oncocyclus irises are replaced by the members of the closely related subgenus, Regelia. In N. India in the region to the south of the Karakoram and Himalayan Mts. are found a few species constituting the subgenus Pseudoregelia, so named on account of the affinity of its members to those of the subgenus Regelia. The peculiar oriental subgenus Pardanthopsis contains only a single species, *I. dichotoma*, which is found in Manchuria and N. China. The bulbous irises comprise three subgenera, Xiphium, Juno, and Gynandriris. The subgenus Xiphium is sometimes divided into two sections, the Xiphiums proper, which occur in Spain, Portugal, Sicily and N. Afr.; and the reticulata irises, which are found in Asia Minor, Transcaucasia and Turkestan. The Juno irises occur in Spain, N. Afr., Asia Minor, Persia, and eastward to India. The single species of the monotypic subgenus Gynandriris is distributed from Portugal to N. W. India.

Something over 100 species of Iris, with innumerable garden varieties, are offered by dealers in America. Many of these, including the native species, are cultivated only to a slight extent, so that horticultural interest centers chiefly around the groups described below.

1. *German irises.*—Under this head may be grouped the tall European pogonirises and the numerous varieties and hybrids derived from them. Besides *I. germanica*, which may be taken as the type of this class, the principal species of the group are *I. aphylla*, *I. variegata*, *I. florentina*, *I. pallida*, *I. Cengialti*, *I. flavescens*, *I. plicata*, *I. Swertii*, *I. Kochii*, *I. lurida*, *I. neglecta*, *I. sambucina*, *I. squalens* and *I. hybrida*. Many of these which are usually recognized as species are undoubtedly of garden origin. *I. germanica* itself is not certainly known to occur in a native state. *I. florentina* or *I. albicans* is a common ornament in Mohammedan cemeteries and was undoubtedly distributed throughout the Mediterranean region by the Mohammedans, who carried it everywhere with them as an embellishment for graveyards. *I. Kochii*, *I. lurida*, *I. neglecta*, *I. sambucina* and *I. squalens* are probably hybrids of which there are innumerable forms in this group. *I. Swertii* and *I. plicata* are pale forms of *I. Cengialtii* and *I. pallida*, in which the color is absent except along the margin of the segments. *I. hybrida* probably represents a similar derivative of *I. variegata* in which the yellow color is absent. Owing to their diversity of origin, the varieties of this group have a great diversity of color, ranging from pure white through all shades of mauve and blue to dark purple. From *I. variegata* and *I. flavescens* the yellow-flowered varieties and those whose flowers are variegated with yellow were probably derived. The flowers of all the varieties are large and handsome, often stately, exhibiting beautiful variegation and shades of color. They are borne on stout, erect, branched stalks much exceeding the clumps of spreading leaves. All are hardy, and form excellent border plants, flowering in May and June.

2. *Japanese irises.*—All the plants cultivated as Japanese irises are referable to a single species, *Iris lævigata*, more commonly known as *I. Kaempferi*. The type of the species has been so much broken that its varieties constitute a distinct horticultural group, containing perhaps as many or more named varieties than the germanica group itself. So far as known, no hybrids or other species enter into the make-up of this class. The plants form strong clumps, attaining a height of 2 to 3 feet, and bearing several flower-stems. The leaves are slender, erect, growing almost parallel to each other. In the wild type the inner segments are erect and rather small. The cultivated forms fall into two groups,—the three-petaled forms in which the inner segments have been nearly suppressed while the outer segments constitute the showy part of the flower, and the six-petaled forms in which all the segments are large and spreading giving the flower the flat expanded form characteristic of the group. The flowers range in color from white through various shades of blue to deep purple, with the segments variegated with darker veins and streaks, or plain. All the varieties are hardy, and thrive best in cool, moist situations. They begin flowering in the latter part of June and continue through July.

3. *The tall apogon irises.*—Besides the Japanese irises, two other groups of apogon irises deserve mention on account of their ornamental value. These are the sibirica group and the spuria group. The species of the sibirica group which are of horticultural interest are *I. sibirica*, *I. sanguinea*, *I. Wilsonii*, and *I. Delavayi*. The plants of this group are characterized by long grass-like leaves growing in close tufts from which

arise clusters of tall branched flower-stems 2 to 3 feet in height. *I. sibirica* has several varieties ranging in color from deep blue to white. These, with the addition of *I. Wilsonii*, make it possible to have tall clumps of blue, white, and yellow irises of the sibirica type. *I. sanguinea*, which has the flowers partly hidden among the leaves is less ornamental than *I. sibirica*, in which the flowers are raised high above the leaves. *I. Delavayi* is a blue-flowered species which flowers in July when most other irises have passed. The plants of this group all thrive best in rather moist situations. Of the spuria group, only the tall ornamental forms closely allied to *I. spuria* are considered here. The most commonly cultivated forms are *I. spuria*, *I. halophila*, better known as *I. Gueldenstædtiana*, *I. orientalis*, *I. Monnieri* and *I. aurea*. These differ from each other only in minor characteristics such as color and slight modifications in the shape of the segments. They are frequently all regarded as varieties of a single type, *I. spuria*, but for horticultural purposes it is more serviceable to treat them as separate species. Besides those forms which may be said to approach specific rank, innumerable minor varieties exist in the group. The color of the flowers ranges from blue in *I. spuria* to bright yellow in *I. Monnieri* and deep yellow in *I. aurea*. In *I. orientalis* the flowers are pale yellow bordered with white. The proportion of white and yellow varies much in different specimens. The plants of this group are tall and stately with leaves 1 to 2 feet long, drooping gracefully above. The flower-stems usually rise high above the leaves, and bear two to three heads of flowers. Those on the lateral branches are held close to the main stem so that the whole inflorescence has the appearance of a spike. The stems are usually 2 to 3 feet high. Those of *I. aurea* are said to grow to a height of 5 feet in California. Some of the species are natives of swampy regions and consequently thrive well in wet places. All grow well, however, in almost any situation.

4. *Dwarf irises.*—Dwarf irises occur in several subgenera but the best-known and most commonly cultivated forms are the dwarf European pogonirises, including *I. pumila*, *I. pseudo-pumila*, *I. biflora*, and *I. Chamæiris*. These are remarkable for their numerous color varieties, which range from pale yellow to lilac, blue, purple, and very dark red. Most of the forms in cultivation are varieties of *I. pumila* and *I. chamæiris*, but many of the garden forms which pass as varieties of *I. pumila* are derived from *I. Chamæiris*. *I. pumila* and *I. Chamæiris* are the most satisfactory of the group, as the others are less hardy or less florifer-ous. *I. arenaria*, the Hungarian form of *I. flavissima*, thrives well in dry sandy situations. The most common dwarf forms among the apogon irises are *I. humilis*, *I. ruthenica* and the American *I. verna*. Of these, *I. verna* is the most striking because in all characteristics of habit and growth it resembles a pogoniris but lacks the beard characteristic of that group. *I. cristata* and its close relative, or perhaps subspecies, *I. lacustris*, are dwarf American forms belonging to the subgenus Evansia, or crested irises. The dwarf irises seldom grow over 9 inches high. They spread rapidly by their creeping rhizomes and soon form large patches. This habit makes them useful as border plants.

5. *Oncocyclus irises.*—The oncocyclus irises differ from other irises in several striking characteristics. The seeds have a creamy-white aril nearly as large as the seed itself. The stem is surmounted by a long, unkeeled tubular spathe which reaches beyond the top of the perianth-tube. The stem bears a single flower, which in some species is of enormous size, compared with the size of the plant. The segments, of which the inner are larger than the outer, present a most singular combination of somber colors. The peculiar colors are often due to the interlacing of numerous very thin veins, usually blue or brown, on a white or straw-colored ground. The most common shades thus produced are beautiful sky-blue, light gray, and brown to almost black. In some, all the segments are colored nearly alike, but in most species the inner and outer segments are differently colored. The species fall into two groups according to their geographical distribution. With their distribution other characteristics are curiously correlated. The species occurring in central and eastern Asia Minor, Transcaucasia, and the mountains of northern and western Persia are dwarf slender species differing from each other by well-marked characteristics. Those found in Palestine, Syria and Mesopotamia are tall, attaining a foot or more in height, and resemble each other so closely that they cannot be distinguished by any characteristic except the color of the flowers. These apparently are all varieties of a single species. In America the oncocyclus irises are not widely cultivated. The most commonly grown form is *I. susiana*. Many hybrids have been raised in Europe. For a monograph, see Foster, Gn. 43, pp. 130–135.

6. *Bulbous irises.*—About 20 species of bulbous irises are cultivated in America. They are rather dwarf, hardy and half-hardy bulbous plants, known chiefly for the brilliant colors and strong contrasts, and for their numerous flowers. The species most commonly found in gardens are *I. Xiphium*, better known as *I. hispanica*, and *I. xiphoides* or *I. anglica*. The latter is probably the oldest iris in cultivation. See Foster, G. C. II. 23, pp. 567 and 726, and Foster, Bulbous Irises (1892).

HEINRICH HASSELBRING.

The cultivation of irises.

As will be seen by their distribution, irises are especially adapted by their hardiness to growth in our gardens, though some forms, as the African, the Indian, and the Oncocyclus species, need special treatment or protection. In the main, the irises, from a cultural point of view, are like others of the various natural families, mostly very good—not to say commonplace—with a few decidedly inferior members. As there are nearly 170 species of irises, with countless varieties, they are interesting to the amateur collector and grower both for their variety and their general beauty of flower.

The life of iris flowers varies from three to six days. They are fragile, but if cut before the petals unroll may be forwarded to considerable distance without injury. This is the only way, in fact, by which the florist can market them. The botanists divide the irises into two main groups, the bulbous kinds and those with rhizomes, these groups being each divided by the varying characters of the more or less raised line in the middle of the fall of the flower. This, of course, gives no clue to cultural necessities or to time of flowering, two important details in a garden.

Considering the bulbous irises as a group, these are all hardy without protection in the latitude of New York city except *I. Histrio*, *I. alata*, *I. juncea*, *I. palæstina*, *I. tingitana*, *I. Vartanii*.

In the order of their flowering, the reticulata group is the earliest, *I. Bakeriana* and others starting into flower as soon as released by frost, usually in February or March. These are soon followed by the others of this group, the largest-flowered member being *I. histrioides*. A peaty, sandy soil seems to be most acceptable to this group, and no organic manure must be given them. A location, if possible, where they may be kept on the side of dryness in summer is desirable. The culture of these, like that of all exotic plants in our gardens, is, of course, tentative. If, on trial, they seem to be happy and increase from offsets or buds, they may remain in the borders indefinitely, but if during the second season they show no gain, the bulbs should be

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lifted and a trial made in another location. This group seeds freely, and the seed-pods will be found just under the soil surface.

Closely following this group are the so-called Juno irises, of which *I. persica* is the most familiar, though not the best example. These irises have somewhat large bulbs, with curious persistent, fleshy roots, and seem to thrive best in somewhat stiff soil, in sheltered locations, where they will be well baked during the summer. They flower in March and April, the best forms being *I. Rosenbachiana, I. orchioides, I. sindjarensis*, and *I. assyriaca*. They are desirable plants in the most exclusive gardens. They seed freely, and also increase by offsets.

About the same time as above will flower the *Iris tuberosa* ("The Widow"), which is neither bulbous nor an iris strictly, but has a weird beauty of its own, with its green and black flowers. This should have a summer baking. See *Hermodactylus*.

Planted out in the early fall, the so-called Spanish irises make an early start and produce leaves which are persistent during the winter and seldom injured here. In May and June they broaden out, and are then surmounted by very bright, distinct and charming flowers. Very satisfactory flowers, these, and of the easiest culture. They probably do best in spots inclining to moisture. The bulbs make offsets rapidly, and should often be divided and replanted. There are two forms and numerous flowers of this iris. The boldest form is that known as the "Thunderbolt." Spanish irises, under mild forcing are now largely grown by florists for early spring flowers.

The "English" irises, *I. xiphioides*, follow the "Spanish" in June and July. Their flowers are wider in all their parts, and in a limited range of colors, white and purple. "Mt. Blanc," pure white, is probably the most satisfactory of the group. The foliage of the English iris does not bear till early spring, and the varieties flourish in a rather drier position than the "Spanish."

The African bulbous irises, *I. juncea, I. Vartanii, I. alata*, are subjects for a coolhouse, though the former is rarely hardy here.

The rhizomatous irises may be divided into a number of sections, but in a cultural way may be broadly considered in two sections: those with thick, surface-creeping rhizomes, as the hybrid German, and those with more or less thin ones, as *I. sibirica* and *I. lævigata*, which are subterranean. While the former section comprises plants which grow in various conditions, some with the roots submerged, yet in a general way they have mostly surface-creeping rhizomes. These are best transplanted soon after flowering, at which time they commence a new growth. It is customary for the nurserymen to supply these in the fall, which usually leads to the loss of a season, as they often fail to become established when planted late. The foliage of the iris indicates a sun-loving family, and irises should be planted in full exposure in rich, but not manured soil, well drained. The rhizomes should be planted flat and covered to half their diameter. If the rhizomes are in a growing condition, no further care will usually be necessary with the larger number of the species, but if the rhizomes are dormant and partly dried up, as they are frequently on receipt, care should be taken that they have not much moisture till they start into growth, otherwise they are likely to rot. Not every iris will grow in every garden, but the failure to establish these plants is most often caused by too much exposure to excitement of light, warmth and moisture when the plant is not ready to convert its reserve into food. Valuable species should have the protection of a frame in such circumstances till it seems safe to plant them out. If carefully treated and not excited, apparently hopeless dried-up rhizomes may often be saved. Most of these irises in common cultivation increase rapidly, and should be divided and replanted every two or three years; otherwise the rhizomes become matted and the abode of grass. Among them will be found some of the showiest flowers of the family.

Usually in early May *I. Chamæiris* and its variety *I. olbiensis* flower, followed quickly by the dwarfer *I. pumila* and its white form *I. attica*. Forms of *I. lutescens*, Lam., quickly follow, after which *I. germanica, I. florentina* and the host of "hybrid German" varieties come rapidly forward and give a great wealth of color. Everyone is familiar with the great bearded purple *I. germanica*, perhaps the most generally cultivated iris. There are larger-flowered forms of this: *I. amas* and *I. macrantha*. *I. germanica alba* seems to be a variety of *I. albicans*. This and *I. florentina* are the usual white-flowered forms seen at this time. Of bold, lighter purple kinds, *I. pallida* and its hybrids are then preëminent.

The German irises of the garden are not varieties of *I. germanica*, but hybrids of various species, as *I. pallida, I. variegata, I. sambucina, I. squalens, I. lurida* × wild forms and *I. neglecta, I. amæna, I. plicata* and *I. Swertii*, which are known only in gardens. Naturally these vary much in stature, time of flowering, size and coloring of flowers. They may be had in almost endless variety, but a typical collection may be made with comparatively few plants.

Among the best forms of the "hybrid German" irises are: *I. aphylla*—Bridesmaid, Madame Chereau, Swertii; *I. amæna*—Compte de St. Clair, Fairy Queen, *reticulata alba*, Victorine; *I. neglecta*—Cordelia, Wagner; *I. pallida*—Khedive, Mad. Pacquitte, Queen of May, Walmer; *I. squalens*—Arnols, Jacquiniana, Harrison Weir, Mons. Chereau; *I. variegata*—Beaconsfield, Darius, Hector, Honorable, Prince of Orange.

June is flowering time for many iris species, many of which are uncommon, but of the more available forms one could scarcely neglect the native *I. hexagona*, the dark La Mance form of which is very distinct and amongst the handsomest of the family. A white form of this is not hardy here. *I. fulva*, another native plant with copper-colored flowers, is also interesting. Irises with distinct forms are *I. Monnieri* and *I. orientalis* (or *I. ochroleuca*), both of which have obliquely growing rhizomes and enjoy moisture.

For margins of water *I. Pseudacorus*, with yellow flowers, is invaluable, and our natives, *I. versicolor* and *I. caroliniana* seem as happy in the moisture as in the uplands. The iris rhizomes which require deep planting are mostly smaller and thinner than those of surface creepers. The species with these roots are mostly strong-growing plants, rapidly increasing and requiring an abundance of moisture, though there are some notable exceptions to be mentioned later. Of the members of this group, *I. sibirica*, in several purple and white forms, is a common garden plant. *I. ensata* is a common Asiatic iris with small flowers borne among the narrow foliage, which is as ornamental as some of the large grasses.

The Japanese irises, which usually end the general display of irises, are a remarkable example of type-breaking, the occidental gardeners having worked up from *I. lævigata* a wonderful variety of colorings and variation in number of petals, though the colors may be included in about half a dozen general types. There are few handsomer flowers than good forms of the white Japanese iris. This iris may be grown on the upland, but it does not do its best in such locations, for it is particularly susceptible to good treatment, and to produce large flowers both water and manure are essential. Peter Barr, the veteran fancier of good plants, wrote from Japan, after consulting one of the oldest cultivators, that "this iris is grown in the rice-fields in winter and watered each month while at rest with human manure (cow manure would do); as soon as young growth appears no more manure is given and

the ground is flooded. When growth has ended the water is withdrawn."

One of the most curious things in connection with the Japanese iris is that though these plants have been in cultivation here since soon after the treaty ports were first opened, they seem to have excited little attention from gardeners until within a few years. Yet the first importations were as handsome as the later. In this connection it may be said that Japan has also *I. gracilipes*, a dark purple hardy form, and *I. japonica* or *I. chinensis*, one of the beauties of the family but, like *I. tectorum* (the roof iris), another crested kind, needing here greenhouse protection and well worth it. There is, however, a perfectly hardy crested iris, the beautiful dwarf *I. cristata* of the upper southern states—a charming plant for a front border or rockery. Equally dwarf are our lake irises *I. lacustris* and *I. verna*.

The west coast of the United States is fortunate in possessing some beautiful and distinct irises, mostly of the wiry-rooted, thin-leaved type. They have not yet been fully separated botanically, and they are most difficult things to establish in eastern or other gardens, so that there are really very few in cultivation.

I. macrosiphon, *I. Hartwegii*, *I. Douglasiana*, *I. bracteata*, *I. tenax*, *I. longipetala*, *I. tenuis* and *I. Purdyi* is a list which will interest the searcher after interesting plants. Max Leichtlin, who has a genius for growing difficult things, has been successful in establishing *I. bracteata*, *I. macrosiphon* and *I. Purdyi*. He says, "My experience is that they cannot be moved unless in full vegetation. We must grow them from seed, and not touch the seedlings until they have formed a solid rootstock. After this and movement to grow has begun, they can be safely handled and transplanted like other irises."

Seed should be sown in the open in autumn, plants appearing in the spring should be undisturbed, and in the fall covered with a frost-proof frame. They should flower the second (or third) season. After flowering they may be shifted carefully, but must always have protection as they naturally commence to grow very early and frosts are fatal to them. Only in this way is there much chance of success with these rare plants. Some of the species have been flowered here under harsh conditions but they were survivals of large numbers of collected plants.

There remain to be considered two allied groups, the oncocyclus and regelia. These are considered by amateurs the most interesting groups of the iris family—interesting in the amateur's vocabulary meaning something rare and difficult. At the best, these plants give few flowers, but they compensate for this by their distinct and quaint beauty. The best-known member of the family, *I. susiana*, has been in cultivation several hundred years, but is by no means yet a common plant. It takes more kindly to cultivation than any other of the groups, will usually flower in the border the first year after planting if the spring is not too rigorous; and gardens are not unknown where, from some conditions of fortunate placing or soil, they continue to flourish. It cannot be said that there is any hard and fast formula for growing these irises. They vary among themselves as to their requirements, and need special and different treatment in different gardens and climates. These irises are natives of Palestine, Asia Minor, the Caucasus, central Asia and Persia regions, all of which are hot and dry in summer, with a settled and sometimes severely cold winter and a genial spring. In some of the regions they are protected by a covering of snow in winter while dormant, but Palestine and Persia have open winters, and their irises make growth at this time. After cultivating most of the species for a number of seasons, the writer's experience does not lead him to dogmatize much on their cultivation or to approve of many special devices which have been put forward from time to time as the solution of the problem. The consensus of opinion among the growers who have had the best success with these plants is about as follows, premising that one is dealing with plants which are perfectly hardy: The rhizomes are received with the Dutch bulbs in the fall, at which time they are dormant and leafless. It is well to store them in a cool place and plant out in November in a bed of fairly light and well-drained soil in a border fully exposed. They require no protection, but if the climate is one where frosts and thaw alternate, it is well to give the ground a covering while frozen to keep it firm. The irises so planted will seldom spear here till genial weather arrives, and with plentiful supplies of moisture at the root will give flowers from strong buds. After flowering, or, more accurately, flowering time, one is forced to choose between two methods of treatment. If the garden is high, dry and hot, the best procedure is to cover the beds with a glass frame sufficiently large to protect them from moisture and allow the rhizomes to bake. This frame may be removed in the late fall. If the leaves appear, as some of them are likely to do, they may be left unprotected until very severe weather sets in, that is, usually in December. Coal-ashes have also proved satisfactory, though unsightly. Foliage does not seem to become as soft under them as under leaves or mats. If the spring is genial, with weather steadily becoming warm, the plants, being uncovered as soon as the conditions will seem to warrant, should be in the best possible shape to reward one with their noble blooms. It is the lack of this genial spring in the latitude of New York which, however, leads often to cultural troubles. The leaves, having been protected, are none too hard, and, with the constant alternate thawing and freezing, and the high winds, hot and cold, the plants need constant watching and application of needed covering till really genial weather. Otherwise the foliage is blighted and no flowers are produced. The most satisfactory way, if one is more interested in results than in garden problems, is to grow oncocyclus and regelia iris and the numerous hybrids which are now available continuously in a coldframe. The frame should be located where drainage is perfect with no bottom moisture, so that the plants may be kept perfectly dry and baking after the blooming season. The plants should be protected from hard freezing after leaves are formed, but should not be protected enough to make them soft. The trouble of this procedure is well worth while if one wishes a rare display.

In gardens which are low and never free from moisture, the best procedure is that followed in Holland, lifting the rhizomes in July and taking them under cover in dry earth, planting out again in the fall. In this case care should be used in lifting not to injure the numerous fleshy roots. The Palestine and Persian forms of these irises are considered the most difficult to cultivate, from their habit of early growth.

Irises are not only increased by the division of the rhizomes or by offsets, but may be rapidly grown from seed, which they usually produce freely, though, in most cases, they require artificial fertilization. A large number of the common irises of gardens are hybrids, and of late years a number of beautiful hybrids have been produced between some of the rarer oncocyclus species, and between these also and common forms, as *I. variegata*, and so on. There are still opportunities to produce many new and untried crosses, and experiments in this line are recommended. The pollination of the iris is simple. The anthers should be removed when the flower first opens, and preserved in paper or vials, properly marked. The pollen will retain its potency for a week or perhaps longer, and may be applied to the stigma of the flower selected (the anther of which has been removed promptly) with a camel's-hair brush. The stigma will be found near the apex of the petal-like style, and is ready for pollination when the upper edge drops down and exposes the upper surface. Many iris

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seeds germinate with considerable irregularity, and failure to start promptly should not lead to discouragement or discarding of the pan in which the seeds are sown.

J. N. GERARD.

The iris in California.

Because such a large proportion of the iris come from around the Mediterranean and so are accustomed to a thorough baking and drying out in summer, their culture is especially satisfactory in California and the range of varieties available so large that some may be found in flower in all but the late summer months. The first rains usually start a few of the dwarf and tall bearded iris into a premature flowering, this being so regular in the case of the *Iris Kochii* that it is now being sold as a fall bloomer. *I. stylosa* (*I. unguicularis*) also flowers in the fall and early winter, accompanied at the latter time by the smaller bulbous irises, such as *I. reticulata*. From February on, the dwarf bearded irises (*I. pumila* and the many slightly taller forms of *I. Chamæiris*) are covered with masses of flowers in various shades of cream, yellow, blue, and purple. In March and April one has a choice of the tall bearded or so-called German iris, the oncocyclus group, *I. spuria*, *I. ochroleuca*, *I. aurea*, *I. Monnieri*, and their cross-bred relatives, as well as the native Californian species and the moisture-loving Siberians. May sees the Spanish irises at their best, followed toward the end of the month by the English iris, and the season ends in June or July with the big Japanese.

The cultural directions for California are simple, varying somewhat with each main group. The tall bearded varieties grow so easily and are so clean and so nearly evergreen that the type (*I. germanica* and its white form) is often used for planting between sidewalk and curb. Yet the many beautiful kinds to be found in the *I. pallida*, *I. plicata*, *I. neglecta*, *I. variegata*, and *I. squalens* sections are not very often seen, although their culture is quite as easy. All they require is sunlight and a place which becomes quite dry in the summer, the easiest possible conditions to supply in California. They dislike shade and standing moisture. Soil is not important, as equally fine results have been secured in the heavy adobe of the valleys and in gravelly hillside loams. Divide to single rhizomes and replant when they show signs of being crowded. This is best done just after blooming or in late summer, but it is possible at any time of the year.

Next to the above, the bulbous Spanish irises give the best garden effect and lead in usefulness as cut-flowers. The little bulbs should be at least 3 inches underground by October, if possible, as they dry up if left too long before planting. Distance apart is a matter of taste, but they may go as close as 3 inches if space is valuable, and may even be used as a top crop between tulip or daffodil bulbs to keep up the show in a small garden. Plant in any cultivated soil, but see that drainage is good, as the stems rot off if subjected to stagnant water. After blooming, do not cut the stems to the ground if flowers are desired next year, for the slight foliage is needed to ripen the bulbs. Many of the best varieties, however, are so cheap that where ground is valuable they may be discarded after blooming, though if left to ripen properly they will increase so rapidly that division will be necessary every other year. English irises are not nearly so satisfactory, though their flowers are larger. They need much more moisture than the Spanish irises, and are more to be recommended to those who can give plenty of water and partial shade.

The oncocyclus and regelia irises do better in California than anywhere else in America, as they must be dried off in summer and no artificial means are necessary here. Contrary to European practice, the best success is achieved by planting as soon as received in October and encouraging growth so that the plants will be ready to bloom in March and April. No special soil is recommended, but it is desirable to cater to their lime-loving taste by incorporating old plaster and bone-flour in the earth. They are nowhere easy plants to grow, so, if success be achieved the first year, leave the roots alone. Under these conditions, *I. susiana*, *I. atrofusca*, *I. iberica*, *I. Lortetii*, *I. Korolkowii*, and others bloom quite well. The Juno irises do fairly well under these same conditions, but are still rather an experiment.

Most striking features of many gardens in April are huge clumps of *I. orientalis* (*I. ochroleuca*). For culture these can be grouped with *I. spuria*, *I. aurea*, and *I. Monnieri*, as all like lots of water during their growing season, which is fortunately our rainy one, but again somewhat contrary to experience elsewhere they can get through the dry season without irrigation.

The Siberian and Japanese iris, however, need moisture as much here as elsewhere, and, though the amount required may be lessened by heavily mulching the bed with rotten manure, they are certainly less adapted to our natural conditions than the other sections of the genus. In the warmer, sunnier parts of the state, the flowers often burn badly and have to be protected with lath screens, an unsightly arrangement. Their most suitable place is in a Japanese garden where they can get the overflow of a pool, and if this is in the summer-fog belt they are quite satisfactory.

The Californian iris are well worthy of garden cultivation, *I. Douglasiana*, with its range of color from purple through lilac to buff, being especially attractive. Do not dig up the wild plants when in bloom, as they will not move well at that time. Either raise from seed or lift them when growth starts in at the beginning of the rainy season, this being the only safe time to move any of the native species.

Twenty-five distinct tall bearded irises for California, omitting only expensive novelties:

Asiatica (Kharput), amas, Kochii.

Pallida, pallida dalmatica (Princess Beatrice), Albert Victor, Queen of May, Madame Paquette.

Madame Chereau, Mrs. Reuthe.

Mrs. Horace Darwin, Victorine (weak grower), Isolene.

Perfection, Cottage Maid.

Darius, Gracchus, Hector, Mrs. Neubronner.

Jacquesiana, King of Irises.

Cengialtii, florentina, flavescens, cypriana superba.

SYDNEY B. MITCHELL.

Orris-root cultivation.

Orris-root (corruption of *iris-root*) is apparently the product of *I. germanica* and related species; the violet-scented roots are used for perfumery powders, dentrifices, and for bad breath; the "fingers" made from the rhizomes are used for teething babies.

As orris-root is no longer used for artificial violet, the price has receded to normal, and probably if grown in this country would not pay. However, as it is likely to be of interest to the public and experimenters, the following notes are quoted from L. J. Keena, Florence, Italy, in a commercial publication.

"The soil in which this root is grown has much to do with the quality, as well as with the quantity and fragrance of the root, and therefore with its commercial success. This plant grows in different kinds of soil, but that best adapted to its growth is the stony mountain soil. This, however, must be scientifically prepared so that the under soil will not remain compact, for that would be disastrous to the plant during the summer months. In a loose soil containing sand the roots grow well, but are less odorous and compact. Rich yellow soil is still less adapted to its culture, as the

plants die quickly. The rich land near manure-piles produces a great quantity of plants, but the roots are neither of good quality nor fragrant, and when dried shrivel up and are consequently discarded by the buyers. The situation or lay of this land matters little, though the best ground is usually found on hillsides. The plant also grows high up in the mountains, where snow and ice make the cultivation of it difficult. In these high places the root takes a few years more to reach its full growth.

"The most suitable soil for orris-root is that which has been prepared by spring seeding with some variety of leguminous plant, and which has been well prepared and deeply plowed. The best months for planting the iris are August and September, although it may be planted as late as the first part of October. The first two months mentioned, however, are preferable for the planting, as the plant begins to grow immediately upon being placed in the ground.

"The best method for planting in soil that has already been prepared is to make holes with a hoe about 16 inches apart, beginning at the bottom of the hill One plant should be placed in each hole resting on the wall of the hole and having its root just reach the bottom. This permits the perfect development of the bulbous root. To insure good production, the soil should be hoed in May and again in September. Irrigation is not beneficial to the plants, as the roots become less compact in irrigated land and there is a dangerous tendency toward fermentation. Fertilizing the soil with manure has the same effect, but if the production of a large number of plants is desired, a system of fertilizing with rich soil can be adopted. The best fertilizer is the seed "lupino" (*Lupinus albus*), which, after being cooked in an oven, is placed in small quantities near each plant at the September hoeing of the first year, if it is to be a two years' growth, and in September of the second year, if for a three years' growth. If the field is to be replanted with orris-root the soil should be well fertilized, and grain, grass or some other crop grown thereon for three or four years.

"The gathering of this product begins during the last fifteen days of June, and is carried on in the following manner: Several men hoe out the plant as a whole, distributing only so many of the plants as can be handled by the rest of the force during the following day, because the plants dry quickly when exposed to the sun and wind. The plants are then carried to a shelter, where the bulbous part of the root is cut off, care being taken to leave enough of the root extensions to insure a good growth for the following years. The bulbous root is then cleaned and scraped free of all imperfections. After the scraping, it is washed by hand in a succession of basins of running water.

"The roots for market are then dried in the sun, with provisions for covering and protecting from the ruinous effects of rain. It is well to set the roots outside before sunrise in order that they may receive the bleaching effect of the dew. After eight days' exposure to a strong sun, the orris-roots can be taken in under cover and packed in a dry place. Preferably the roots should be pulpous and as white as possible. Artificial drying in ovens or in any other manner depreciates the value of the product by making it less than if sun-dried. In the drying process the weight of the root becomes two-thirds of what it was when cut from the plant."

INDEX.

acoroides 73.
acuta, 65.
alata, 89.
alba, 3, 6, 25, 65, 67.
Alberti, 24.
albicans, 25.
albopurpurea, 84.
amœna, 31.
anglica, 100.
aphylla, 14, 20, 21.
arenaria, 11.
Aschersonii, 57.
asiatica, 19.
assyriaca, 96.
atrofusca, 49.
atropurpurea, 6, 30, 44, 49.
atroviolacea, 6, 18.
attica, 6.
aurea, 81.
azurea, 6.
Bakeriana, 108.
balkana, 10.
Barnumæ, 42.
Battandieri, 99.
benacensis, 14.
bicolor, 6.
biflora, 8.
biglumis, 61.
Biliottii, 26.
Bismarckiana, 51.
Bloudowii, 11.
bohemica 14.
Boissieri, 102.
Bornmuelleri, 86.
bosniaca, 10.
brachycuspis, 77.
bracteata, 68.
cærulea, 6, 94, 105.
candida, 3.
caroliniana, 76.
caucasica, 92, 94, 98.
Cengialti, 13.
Chamæiris, 9.
chinensis, 3, 5.
chrysantha, 41.
cælestis, 6.
concolor, 37.
cretensis, 67.
cristata, 1, 3.
cuprea 72.
cyanea, 105.
cypriana, 29.
dalmatica, 19.
Danfordiæ, 86.
darwasica, 38.
Delavayi, 63.
desertorum, 83.
dichotoma, 52.
Douglasiana, 70.
Eggeri, 44.
ensata, 61.
erratica, 7.
Ewbankiana, 46.
falcata, 14.
Fieberi, 14.
filifolia, 103.
fimbriata, 3, 5.
flava, 73.
flavescens, 22, 23.
flavissima, 11.
flexuosa, 65.
florentina, 25.
fœtidissima, 82.
Fosteriana, 93.
fragrans, 8, 61.
fulva, 72.
fumosa, 97.
furcata, 14.
Gatesii, 47.
germanica, 30.
gigantea, 80.
gracilis, 6, 14, 66.
graminea, 59, 61, 69.
Grant-Duffii, 57.
Gueldenstædtiana, 79.
hæmatophylla, 61, 64.
halophila, 79, 83.
Hartwegii, 56.
Haussknechtii, 87.
Haynei, 49.
Heldreichii, 87.
Helenæ, 43.
hexagona, 75.
hispanica, 99.
Histrio, 106.
histrioides, 105.
honorabilis, 15.
humilis, 53.
hungarica, 14.
hybrida, 31.
iberica, 40.
imbatrica, 22.
intermedia, 81.
italica, 9.
Jacquesiana, 34.
japonica, 5.
juncea, 101.
Junonia, 28.
Kaempferi, 84.
Kochii, 17.
Kolpakowskiana, 109.
Korolkowi, 37.
Krelagei, 105.
lacustris, 2.
lævigata, 84.
Leichtliniana, 37.
Leichtlinii, 36.
lineata, 38.
longipetala, 62.
longispatha, 61.
Lortetii, 48.
lupina, 45.
lurida, 16, 45.
lusitanica, 99.
lutea, 6.
lutescens, 9.
macrosiphon, 55.
Madonna, 25.
major, 50, 105.
mandschurica, 12.
Mariæ, 43.
maricoides, 110.
Milesii, 4.
minor, 11.
missouriensis, 71.
Monnieri, 78.
nazarena, 51.
neglecta, 32.
nepalensis, 30.
nertschinskia, 64.
nikitensis, 59.
notha, 83.
nudicaulis, 8, 14.
obtusifolia, 22.
ochroleuca, 80.
oculata, 98.
olbiensis, 9.
orchioides, 94, 98.
orientalis, 64, 80.
oxypetala, 61.
pabularia, 61.
palæstina, 90.
Pallasii, 61.
pallida, 19, 73.
panormitana, 7.
paradoxa, 39.
persica, 87.
plicata, 20.
prismatica, 66.
Pseudacorus, 73.
pseudo-pumila, 7.
pumila, 6.
purpurea, 87.
Reichenbachiana, 10.
Reichenbachii, 10.
reticulata, 30, 105, 106.
Rosenbachiana, 88.
ruthenica, 53, 54.
Saarii, 45.
sambucina, 33.
sanguinea, 64.
Sari, 45, 51.
scorpioides, 89.
setosa, 77.
sibirica, 64, 65.
sicula, 19.
Sieheana, 87.
sikkimensis, 35.
sindjarensis, 96.
Sintenisii, 69.
Sisyrinchium, 110.
sogdiana, 83.
speciosa, 19, 67.
spectabilis, 99.
Sprengeri, 46.
spuria, 83.
squalens, 34.
Statellæ, 7.
stenophylla, 87.
stolonifera, 36.
stylosa, 67.
subbiflora, 8.
sulphurea, 6.
superba, 30, 67.
susiana, 50.
Suworowi, 38.
Swertii, 21.
Tauri, 87.
taurica, 6.
tectorum, 3.
tenax, 60.
tingitana, 104.
Tolmieana, 71.
tripetala, 77.
trojana, 27.
unguicularis, 67.
urmiensis, 41.
Urumori, 69.
vaga, 36.
variegata, 15, 65, 73.
Vartanii, 107.
verna, 85.
versicolor, 74.
violacea, 6, 37.
virescens, 9.
virginica, 66, 74.
warleyensis, 95.
Willmottiana, 91.
Wilsonii, 58.
xiphioides, 100.
Xiphium, 99, 104.

INDEX, CONTINUED.

KEY TO THE SUBGENERA.

A. *Rootstock a short, thick, or a slender creeping rhizome.*

B. *Outer segms. of the perianth distinctly crested on the claw and the lower part of the blade*..... EVANSIA. Species 1–5

BB. *Outer segms. of the perianth bearded with multicellular hairs.*

C. *Seeds without a conspicuous aril*..... POGONIRIS. Species 6–34

CC. *Seeds with a conspicuous creamy white circular aril.*

D. *Aril much smaller than the seeds: lvs. not fully grown at flowering-time*..... PSEUDOREGELIA. Species 35

DD. *Aril nearly as large as the seed itself: lvs. fully grown at flowering-time.*

E. *St. 1-headed, 1–3-fld.*..... REGELIA. Species 36–38

EE. *St. 1-headed, 1-fld.: beard diffuse on the claw and the lower part of the blade*..... ONCOCYCLUS. Species 39–51

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BBB. *Outer segms. of the perianth without a beard or crest, sometimes pubescent.*
C. *Infl. a regular raceme: seeds conspicuously winged*.....PARDANTHOPSIS. Species 52
CC. *Infl. not a regular raceme: seeds not conspicuously winged*.....APOGON. Species 53–85
AA. *Rootstock a bulb.*
B. *Inner segms. of the perianth small, often minute, spreading or deflexed*.....JUNO. Species 86–98
BB. *Inner segms. of the perianth large, erect.*
C. *Stamens not adhering to the style-branches.* XIPHIUM. Species 99–109
CC. *Stamens adhering to the style-branches*..... GYNANDRIRIS. Species 110

SUBGENUS EVANSIA.

A. *St. none or very short, evidently exceeded by the lvs.: plants dwarf.*
B. *Perianth-tube very slender, exceeding the bracts*..... 1. **cristata**
BB. *Perianth-tube expanded above, not exceeding the bracts*..... 2. **lacustris**
AA. *St. evident, equaling or exceeding the lvs.: plants large.*
B. *Pedicel much shorter than the spathe*..... 3. **tectorum**
BB. *Pedicel about as long as the spathe or only slightly shorter.*
C. *Lvs. thin, distinctly ribbed, both surfaces slightly glaucous*..... 4. **Milesii**
CC. *Lvs. thick, smooth, with a glossy upper- and a glaucous under-surface*..... 5. **japonica**

1. **cristàta,** Soland. Plant dwarf: rhizome slender, creeping: lvs. ensiform, thin, 4–8 in. long, green: st. 1–3 in. high, flattened, 1-headed, bearing 2–3 lvs.: tube slender, 1½–2 in. long; limb blue; outer segms. obovate, 1–1½ in. long, crested; inner segms. shorter, naked. April, May. Mountains of Ky., Va., and the Carolinas. B.M. 412. Gn. 45, p. 127. L.B.C. 14: 1366.

2. **lacústris,** Nutt. Similar to *I. cristata* in size and foliage except that the lvs. are rather narrower and sometimes wavy margined and the perianth-tube is only ½–1 in. long, shorter than the spathe-valves: fls. blue; segms. expanded above: caps. ovoid, borne on a pedicel of about its own length. Shores of Lakes Huron, Michigan, and Superior.

1965. Iris tectorum. (×⅓)

3. **tectòrum,** Maxim. (*I. chinénsis,* Bunge. *I. cristàta,* Miq. *I. fimbriàta,* Klatt). Fig. 1965. Lvs. 1 ft. long, ensiform, thin, strongly ribbed: st. 1½ ft., subterete: heads on long peduncles; tube 1 in. long; limb bright lilac; outer segms. 2 in. long, obovate; claw half as long as the blade, streaked with violet, with a wavy edge and a large, laciniate, white and lilac crest running up the claw and half up the blade; inner segms. spreading, nearly as large, plain lilac, short-clawed. Sent to Eu. in 1872 by Dr. Hance. Cult. in China and Japan. B.M. 6118. F.S. 22:2282. Gt. 716. Gn. 50:272. G.C. III. 35:355; 44:142. J.H. III. 44:146. G.L. 17:348. Var. **álba,** Dykes (*I. tectòrum* var. *cándida,* Hort.). Fls. pure white, with few faint yellow veins at the base of the segms. Comes true from seed. Gt. 57: 1571. Gn. 70, p. 15. G.C. III. 40:216. G.W. 10:525.

4. **Milesii,** Foster. Lvs. 7–8 on the st., 2–3 ft. long and 2–3 in. broad, thin, strongly ribbed: st. 2–3 ft. high, branched, bearing 4–5 heads: fls. bright lilac, lasting only a day; outer segms. oblong-cuneate, claret-purple, whitish in the center, spotted and veined with lilac, furnished with a deeply laciniated yellow crest; inner segms. oblong, spreading; style-crests deeply toothed. Himalayas. B.M. 6889.—Near *I. tectorum,* but inferior.

5. **japónica,** Thunb. (*I. chinénsis,* Curt. *I. fimbriàta,* Vent.). Fig. 1966. Lvs. ensiform, thick, smooth, 1–1½ ft. long: st. slender, as long as the lvs., with a raceme of lilac fls.: tube ¾in. long; outer segms. 1–1½ in. long, with crimped margins, yellow on the claw, crested; inner segms. smaller. Winter. Japan and China. B.M. 373. Gt. 511. Gn. 28:120; 77, p. 142. J.H. III. 31:185. A.G. 12:704. F.R. 2:149.—An evergreen greenhouse plant except in Calif. where it does very well outdoors in a shady border.

SUBGENUS POGONIRIS.

A. *Plants dwarf: lvs. generally less than 9 in. long.*
B. *Tube of the perianth 1 in. or more in length.*
C. *St. obsolete or very short*..... 6. **pumila**
CC. *St. present, 1–10 in. long.*
D. *Spathe-valves not keeled or only the outer one slightly keeled.*
E. *The st. almost entirely hidden by clasping lvs.*
F. *The spathe-valves lanceolate, membranous, green*.. 7. **pseudo-**
FF. *The spathe-valves oblong, green or scarious above*... 8. **biflora** [**pumila**
EE. *The sts. bare above, with 1–2 reduced lvs. below the center.* 9. **Chamæiris**
DD. *Spathe-valves acutely keeled*....10. **Reichen-** (*See also I. imbricata No. 22*) [**bachii**
BB. *Tube of the perianth short or none.*
C. *Spathe-valves green or only partly scarious.*
D. *Rhizome slender, stoloniferous: sheaths splitting into fibers*....11. **flavissima**
DD. *Rhizome more compact: sheaths not splitting into fibers*.....12. **mandshurica**
CC. *Spathe-valves scarious, even in the bud*.....13. **Cengialti**
AA. *Plants tall: lvs. generally more than 1 ft. long.*
B. *St. scarcely overtopping the lvs.*
C. *The st. branched below the middle*.....14. **aphylla**
CC. *The st. branched above the middle, or unbranched.*
D. *Spathe-valves wholly green when the first fls. open, often flushed with purple, inflated*.....15. **variegata**
DD. *Spathe-valves partly scarious when the first fls. open.*
E. *Fls. dull purple*.....16. **lurida**
EE. *Fls. dark violet*.....17. **Kochii**
DDD. *Spathe-valves entirely scarious at flowering-time*.....18. **atroviolacea**
BB. *St. much overtopping the lvs.*
C. *Spathe-valves entirely scarious at flowering-time or even in the bud.*
D. *Fls. pale purple or lilac*.....19. **pallida**
DD. *Fls. white; segms. veined and flushed with purple or lilac on the margins.*
E. *Sts. 2–3 ft. high*.....20. **plicata**
EE. *Sts. 1–1½ ft. high*.....21. **Swertii**
CC. *Spathe-valves green or partly scarious.*

D. *Fls. yellow.*
E. *The spathe-valves membranous, much inflated, almost wholly green*.....22. **imbricata**
EE. *The spathe-valves firm, not inflated, almost wholly scarious*.....23. **flavescens**
DD. *Fls. purple, violet, lilac, or white; inner segms. sometimes yellowish.*
E. *Spathe-valves much inflated*..24. **Alberti**
EE. *Spathe-valves scarcely inflated.*
F. *Lateral heads subsessile*...25. **florentina**
FF. *Lateral heads stalked.*
G. *The spathe-valves narrow acuminate, almost wholly green, scarious only at the tip and edges*.....26. **Biliottii**
GG. *The spathe-valves narrow acuminate, scarious in the upper half and much tinged with purple*.....27. **trojana**
GGG. *The spathe-valves broad, navicular, not tinged with purple.*
H. *Lvs. glaucous, broad*..28. **Junonia**
HH. *Lvs. slightly glaucous, blue-green, comparatively narrow*....29. **cypriana**
GGGG. *The spathe-valves broad, navicular, much tinged with purple*.....30. **germanica**

The following four forms cannot be separated from each other and from some of the foregoing forms by strictly botanical characteristics. They are probably varieties of hybrid origin as indicated in the descriptions.

Outer segms. blue to pale violet or white; inner segms. white.....31. **hybrida**
Outer segms. blue to bright lilac; inner segms. lighter.....32. **neglecta**
Outer segms. blue-purple with faint darker veins; inner segms. smoky yellow and pale purple.....33. **sambucina**
Outer segms. lilac-purple; inner segms. smoky yellow and pale lilac.....34. **squalens**

6. **pûmila,** Linn. (*I. violàcea,* Sweet. *I. taùrica,* Lodd. *I. cærùlea,* Spach). Fig. 1967. Lvs. linear, 2–4 in. long: st. none or very short, 1-headed: spathe-valves scarious at the tip: fls. fugitive, yellow, or bright or dark lilac; limb 2 in. long. Austria-Hungary, Asia Minor, S. Russia. L.B.C. 16:1506, 1574. R.H. 1903:132. G.M. 49:225 (var. *bicolor*); Gn. M. 15:360.—A dwarf, hardy plant, spreading rapidly in borders. Has many color varieties ranging from dark reddish purple to light purple and yellow. Var. **áttica,** Boiss. & Heldr. (*I. áttica,* Boiss. & Heldr.). Lvs. narrow, falcate: fls. pale straw-yellow tinged with green; segms. with inconspicuous purplish veins, the outer with a purplish or greenish brown patch. Gt. 11:377. Var. **violàcea,** Ker. Fls. bright blue. B.M. 1261. Var. **lûtea,** Ker. Fls. pale yellow. The common yellow form. B. M. 1209. —The following trade names which are self-explanatory have been applied to some of the numerous color-varieties of this species: *I. alba, I. atropurpurea, I. atroviolacea, I. azurea, I. bicolor, I. cœlestis, I. lutea, I. sulphurea. I. gracilis,* E. Berg, is probably a hybrid of this species.

7. **pseudo-pûmila,** Tineo (*I. panormitàna,* Tod.). Lvs. ensiform, glaucescent, 6–9 in. long, narrowed suddenly to an oblique tip: st. 1-headed, 6–8 in. long, clothed with bracts, 1-fld.: tube 2–2½ in. long; spathe-valves green: fls. varying from yellow to bright lilac; outer segms. oblong unguiculate, 2–2½ in. long; inner segms. rather broader. Mountains of Sicily. *I. Státellæ,* Tod., is a hybrid or a sport of this species. The seeds give rise to typical *I. pseudo-pumila* plants. B.M. 6894 is *I. erratica,* Tod. Probably a similar hybrid.

8. **bifiòra,** Linn. (*I. subbifiòra,* Brotero. *I. fràgrans,* Salisb. *I. nudicaùlis,* Hook.). Lvs. 6–9 in. long: st. 2–10 in. long, compressed, usually bearing 2–3 small

1966. Iris japonica (×⅓). No. 5.

clasping lvs. which entirely hide it: fls. bright violet-purple; outer segms. obovate-cuneate, 2–2½ in. long, with dark veins and a beard of long, yellow hairs; inner segms. obovate, unguiculate, lighter, with faint veins. Portugal and N. Morocco. B.M. 1130.

9. **Chamæìris,** Bertol. (*I. olbiénsis,* Henon. *I. lutéscens,* Lam. idem, Delarb. *I. virescens,* Delarb.). Lvs. 3–6 in. long, ½in. broad: st. 1–10 in. long, bare above with 1–2 reduced lvs. below the middle: fls. bright yellow; outer segms. obovate-cuneate, tinged and veined with brown; inner segms. oblong. May. Italy, France. B.M. 2861, 6110. Gn. 63, p. 26.—Distinguished from *I. pumila* by the evident st., the shorter tube, and the more inflated and less membranous spathe-valves. Var. **itálica,** Parl. Fls. dark violet.

10. **Reìchenbachii,** Heuffel. (*I. bosniaca,* Beck. *I. balkàna,* Janka. *I. Reichenbachiàna,* Baker). Rhizome stout; tufts crowded: lvs. 3–6 in. long, ¼–¾in. wide, increasing in size after flowering-time: st. 6–10 in. long, 1-headed, bearing 1–2 reduced lvs.: spathes 1–2-fld., 1½–2 in. long; valves ventricose, green, or slightly scarious: fls. reddish brown-purple with bluish white beard, or yellow with orange beard; outer segms. obovate, cuneate, 2 in. long, 1 in. broad; inner segms. oblong-elliptical, emarginate, suddenly constricted to a canaliculate claw. Bosnia and Herzegovina to Bulgaria and Macedonia.—Resembles *I. Chamæiris,* but differs in the flattened, acutely keeled spathes and the thin texture of the fls. The yellow-fld. forms are often slightly veined with purple.

11. **flavíssima,** Pall. (*I. arenària,* Waldst.). Lvs. thin, linear, 4–8 in. long: st. 1–6 in. long, 2–3-fld.: limb bright yellow; outer segms. 1–1½ in. long, ¾in.

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broad; inner segms. oblong, narrower. Hungary, N. E. Asia and Altai region to Mongolia. B.R. 549. G.C. III. 29:337.—*I. arenaria* is the Hungarian representative of *I. flavissima*. It is smaller than *I. flavissima*, but otherwise scarcely distinct. Var. **Bloudòwii,** Ledeb. (*I. Bloudòwii*, Ledeb.). More robust with broader lvs., a longer st. and larger fls. Gt. 29:1020. Turkestan, Siberia and China. Var. **minor,** Hort. Smaller.

12. **mandshûrica,** Maxim. Lvs. from a short creeping rhizome whose sheaths are not split into fibers, ensiform, 6–8 in. long, ½in. broad: st. 1-headed: spathe 2-fld.; valves 1½–2 in. long, membranous, green with a scarious edge: pedicel short: fls. yellow; tube ½in. long; outer segms. 1½–2 in. long, ½in. broad, obovate-cuneate, truncate, with a yellow beard; inner segms. narrower and shorter; crests of style-branches obtuse, dentate. S. Manchuria.—Near *I. flavissima*, from which it is distinguished by the more compact rhizome and wider lvs.

13. **Céngialti,** Ambrosi. Lvs. ensiform, yellowish green, glaucous, 6 in. long, ½in. broad: sts. 6–12 in. long, usually exceeding the lvs., 1–3-headed: spathes 2-fld., 1 in. long, brown-scarious in the bud but not silvery white like those of *I. pallida:* fls. bright lilac; outer segms. obovate-cuneate, veined with brown-purple on the pale claw, with a beard of white orange-tipped hairs; inner segms. obovate, short-clawed. Lombardy, S. Tyrol.—A dwarf species closely allied to *I. pallida.*

14. **aphýlla,** Linn. (*I. bohèmica,* Schmidt. *I. hungárica,* Waldst. & Kit. *I. furcàta,* Bieb. *I. falcàta,* Tausch. *I. Fièberi,* Siedl. *I. nudicaùlis,* Hook. *I. benacénsis,* Kerner). Lvs. glaucescent, 6–12 in. long: st. equaling the lvs., sometimes forked low down, leafless: spathe-valves greenish, tinged with purple: fls. dark lilac; outer segms. obovate-cuneate, 2–2½ in. long; beard white; inner segms. broader, obovate. E. Eu. B.M. 2361, 5806. B.R. 801. L.B.C. 20:1970.—The plant commonly cult. as *I. gracilis* is probably *I. aphylla.*

15. **variegàta,** Linn. Lvs. 1–1½ ft. long: st. equaling the lvs.: outer segms. oblong-cuneate, claret-brown toward the tip, much veined with brown on a yellow ground; beard bright yellow; inner segms. erect, oblong, bright yellow, veined. Austria, Turkey and S. Russia. Long in cult. B.M. 16. Gn. 14:12; 52:364 (var. *aurea*). G.M. 54:126. Var. **honorábilis,** Hort. Yellow, shaded with brown.

16. **lûrida,** Soland. Lvs. 1 ft. long, slightly glaucous: st. not much overtopping the lvs., 3–4-headed: spathe-valves green flushed with purple, scarious above, very ventricose, not keeled: outer segms. obovate-cuneate, reflexed from half-way down, dead purple at the top, veined with dull purple on a yellowish ground below; beard yellow; inner segms. broader, dull purple. S. E. Eu. B.M. 986, also B.M. 669, which is probably a different plant.

17. **Kòchii,** Kerner. Lvs. 12–15 in. long, glaucescent: st. as long as the lvs., 3–4-headed: spathe-valves lanceolate, the outer herbaceous; the inner partly scarious, tinged with purple along the edge: outer segms. obovate, with a broad cuneate claw, 3½–4 in. long, 1¾ in. broad, dark violet; claw veined with brown; beard yellow; inner segms. broadly obovate, clawed, dark violet, somewhat lighter than the outer. Istria, near Trieste and Rovigno.—Probably a form of *I. germanica* or a hybrid between that species and *I. aphylla.*

18. **atroviolàcea,** Lange. Lvs. very glaucous, 1 ft. long: st. equaling the lvs.: spathe entirely scarious: fls. dark violet, very fragrant; outer segms. obovate-cuneate, 3 in. long; beard white, tipped with yellow; inner segms. as long, 2 in. broad, orbicular. Late May. —Known only in cult. Probably either *I. germanica* var. *atropurpurea* or *I. Kochii.*

19. **pállida,** Lam. (*I. asiática,* Stapf. *I. sícula,* Tod.). Lvs. 1–2 ft. long: st. much exceeding the lvs., 2–3 ft. high: spathe-valves wholly scarious before the fls. expand: fls. fragrant, violet, rarely white; outer segms. obovate-cuneate, 3½ in. long; inner segms. orbicular. Crete, Rhodes, Syria, Palestine. B.M. 685. Gn. 33:32; 50, p. 119. G.M. 38:441. G. 29:179. G.L. 23:147. J.H. III. 54:437 (var. *delicata*). R.B. 30:145 (variety with variegated lvs.).—The spathe-valves entirely scarious even in the bud, the more complicated infl. and the fragrant fls. distinguish this species from *I. germanica.* Var. **dalmática,** Hort. Lvs. 2 in. wide, broader than those of the type, very glaucous: st. shorter and stouter than that of the type: fls. lilac-purple. The finest form of *I. pallida.* J.H. III. 56:545. Var. **speciòsa,** Hort. Tall, with large, light blue fls.

20. **plicàta,** Lam. (*I. aphýlla,* Hort., not Linn. *I. aphýlla* var. *plicàta,* Ker). Rhizome, st. and lvs. as in *I. pallida:* outer segms. obovate, pure white in the center, conspicuously veined with lilac toward the margin and on the claw; inner segms. very plicate, white tinged with lilac on the margin. B.M. 870.—Known only in cult. Probably derived from *I. pallida.*

21. **Swértii,** Lam. (*I. aphýlla* var. *Swértii,* Ker.) Much dwarfer than *I. florentina* and *I. pallida.* St. 1–1½ ft. long: spathe-valves flushed with violet: outer segms. 2–2½ in. long, obovate-cuneate, white, faintly veined and flushed with purple on the margin; inner segms. as large, much crisped, pure white, except the purple keel and margin.—Fragrant. Known only in cult.

22. **imbricàta,** Lindl. (*I. flavéscens,* Sweet. *I. obtusifòlia,* Baker). Lvs. about 6 in a tuft, broadly ensiform, pale green, 6–8 in. long at flowering time: st. 12–20 in. long, bearing a terminal and several nearly sessile lateral clusters each subtended by a ventricose navicular bract: spathe-valves oblong navicular, 2–3 in. long, green, membranous, very ventricose: fls.

1967. **Iris pumila. One of the best dwarf species** (×⅓). No. 6.

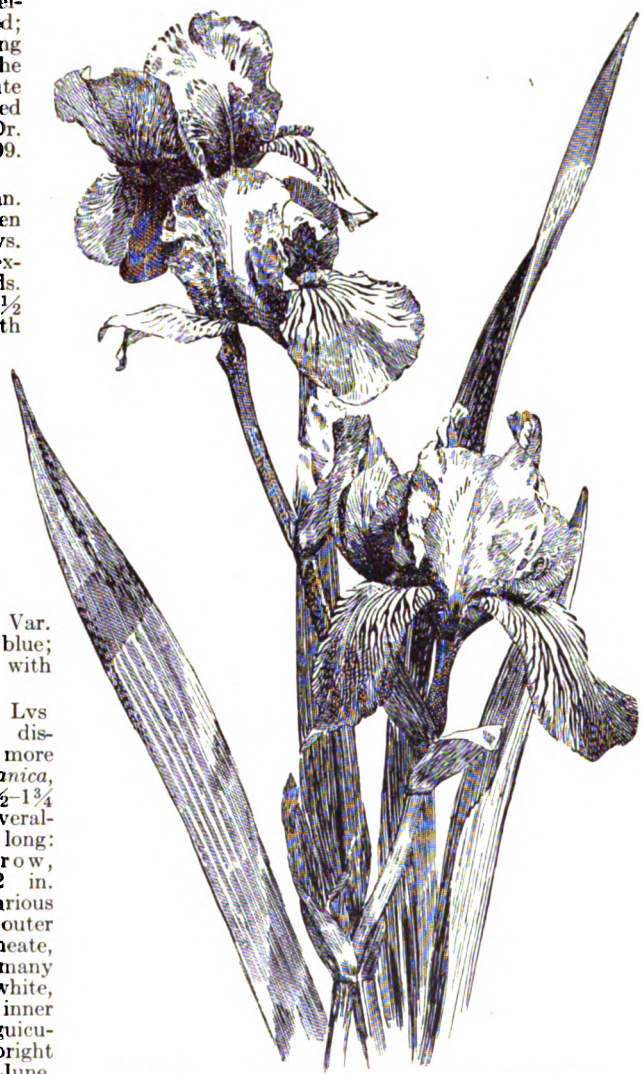
greenish yellow; tube 1 in. long; outer segms. obovate-cuneate, 2 in. long and 1 in. broad, veined with brown on the claw; inner segms. erect, rounded oblong, subcordately unguiculate, mottled with brown on the claw. Transcaucasia and N. Persia. B.R. 31:35. B.M. 7701. —Confused with *I. flavescens,* from which it differs by the membranous inflated green spathe-valves.

23. **flavéscens,** DC. Lvs. 12–15 in. long: st. 2–3 ft. high, bearing 3–4 heads: spathes 2–3-fld., not entirely

scarious at flowering-time: fls. bright lemon-yellow; outer segms. obovate-cuneate, 2½ in. long; beard deep yellow; inner segms. obovate, pale yellow. G.C. III. 48:95.—Known only in cult.

24. **Álberti,** Regel. Lvs. ensiform, glaucous, 1½–2 ft. long: st. exceeding the lvs., bearing 5–6 heads in a loose panicle: spathe-valves mostly green, very slightly scarious at tips: outer segms. obovate-cuneate, 2 in. long, bright lilac, with a rudimentary crest and a dense beard of white, yellow-tipped hairs, veined; inner segms. as long and broader than the outer, with convolute claws, lilac. Discovered in Turkestan by Dr. Albert Regel. Gt. 999. B.M. 7020.

25. **florentina,** Linn. Rhizome fragrant when dried (orris-root): lvs. 1–1½ ft. long: st. exceeding the lvs.: fls. white; outer segms. 3½ in. long, tinged with lavender; claw yellowish veined with purple; inner segms. as large, white. Cent. and S. Eu. B.M. 671. Gn. 16:82; 51, p. 295. G.M. 54:127. —Flowers early, with *I. germanica*. Hardy. Var. **álbicans,** Lange (*I. álbicans,* Lange. *I. florentina* var. *álba,* Hort.). Pure white. Spain to Cyprus. Var. **Madónna,** Hort. Fls. blue; spathe-valves flushed with purple.



1968. Iris germanica. Typical of many species in which the beard is confined to the midrib. (×⅓)

26. **Biliótii,** Fost. Lvs darker green, more distinctly striated, and more rigid than in *I. germanica,* about 20 in. long, 1½–1¾ in. broad: st. several-headed, 2½–3 ft. long: spathe-valves narrow, acuminate, nearly 2 in. long, ventricose, scarious only at the tips: outer segms. obovate-cuneate, reddish purple, with many dark veins; beard white, tipped with yellow; inner segms. orbicular unguiculate, 2 in. broad, bright blue-purple. Late June. Trebizond.—Very near *I. germanica.*

27. **trojána,** Kerner. Lvs. very acute, glaucescent: st. over 3 ft. high, much branched and overtopping the lvs.: pedicel none: fls. bright violet-purple; outer segms. obovate; blade longer than the claw; claw white, bordered with yellow and veined with brown-purple; inner segms. elliptic, suddenly narrowed to a claw; style-crests broad, denticulate. Troad, Asia Minor. G.C. III. 53:170.

28. **Junónia,** Schott & Klotschy. Rhizome stout, compact: lvs. 12–14 in. long, 1¾ in. wide, glaucous: st. 20–24 in. high, bearing a terminal head of 2 fls. and 4 lateral branches, the lowest about 3–4 in. long: spathe 1½ in. long, with pale green valves, scarious in the upper half: pedicel none: outer segms. obovate-cuneate, purple-violet, whitish at the throat and on the claw, veined with yellowish brown; inner segms. obovate, abruptly unguiculate, pale violet, veined and spotted with red-brown on the paler claw. Cilician Taurus.—Differs from *I. pallida* in the spathe-valves, which are only partly scarious at flowering-time.

29. **cypriána,** Foster & Baker. Plants tall, the branching st. being 3 ft. high, bearing many fls. 6–7 in. diam.: outer segms. obovate-cuneate, reddish lilac, with thin, darker veins; claw whitish, with greenish brown veins; inner segms. oblong-unguiculate, lilac, spotted with reddish brown on the claw. June, July. Cyprus.—Very near *I. pallida,* from which it differs only by the longer navicular spathe-valves, which are not entirely scarious at flowering-time, and the more obovate segms.

30. **germánica,** Linn. Fig. 1968. Lvs. 1–1½ ft. long: st. 2–3 ft. high, usually with a 2-fld. terminal head and one short and one longer lateral branch, each bearing a single fl.: spathe-valves tinged with purple, scarious in the upper half: outer segms. obovate-cuneate, 2–3 in. long; beard yellow; inner segms. as large, obovate, connivent. Cent. and S. Eu. Early May, June. B.M. 670. B.R. 818. I.H. 40: 182 (var. *Gypsea,* pure white). Gn. 48:242 (dark purple var.). Gn. M. 15:362. Var. **reticulàta supérba,** Hort. Outer segms. purple, veined; inner segms. lavender. Var. **nepalénsis,** Dykes (*I. nepalénsis,* Wallich. *I. germánica* var. *atropurpùrea,* Hort.). Purple King. Fls. red-purple; outer segms. darker, almost black-purple.

31. **hýbrida,** Retz. (*I. amœna,* DC.). Differs from *I. neglecta* by its longer spathe-valves, and its pure white or faintly lilac-tinted outer segms. and style-branches. June.—Known only in cult.

32. **neglécta,** Hornm. Lvs. slightly glaucous, 12–15 in. long, ensiform, purple at the base: st. taller, 1½–2 ft., many-fld.: spathe-valves green below at flowering-time, much tinged with purple: outer segms. obovate-cuneate, very obtuse, 2 in. long, violet-blue on the margin, whitish veined with blue in the center; beard yellow; inner segms. erect or connivent, oblong, as large as the outer, pale lilac. June. B.M. 2435.—Known only in cult. Probably a hybrid between *I. pallida* and *I. variegata.*

33. **sambûcina,** Linn. Differs from *I. squalens* in its less robust habit, narrower segms. and elder-like odor. The outer segms. are colored and veined with claret not lilac-purple; inner segms. emarginate. Late May. Cent. Eu. B.M. 187. (According to Dykes this figure is probably *I. squalens*, while plate 787, *I. squalens*, probably represents *I. sambucina*. Both forms are very likely hybrids between *I. pallida* and *I. variegata*.)—Tall and handsome.

34. **squàlens,** Linn. Lvs. glaucous, 1–1½ ft. long: st. 2–3 ft. high, much branched and many-fld.: spathe-valves subscarious: outer segms. obovate-cuneate, upper part plain lilac-purple; claw yellow, veined with lilac; beard yellow; inner segms. as large, obovate, dull lilac and yellow, or brownish and yellow. Cent. Eu. to Caucasus. B.M. 787. (See note under *I. sambucina*.) J.H. III. 48:481.—Many of the German irises of cultivators belong to this form. Var. **Jacquesiàna,** Hort. Outer segms. dark red-violet, yellow at base; inner segms. tawny yellow. Late. One of the best.

SUBGENUS PSEUDOREGELIA.

35. **sikkimènsis,** Dykes. Lvs. 4–8 in. long at flowering-time, later 12–18 in. long, ½–¾in. wide, pale green, ensiform: st. 4–6 in. long, bearing a single head of 2–3 fls.: spathes 2–3 in. long, lanceolate; valves scarious in the upper one-third and along the edges, keeled: tube 1½–2 in. long; outer segms. obovate, contracted to a cuneate claw, 2½ in. long, 1 in. broad, dark lilac, mottled with a deeper shade; beard of white orange-tipped hairs; inner segms. spreading, with an oblong, deeply emarginate blade suddenly contracted into a canaliculate claw, pale lilac; faintly mottled with a deeper shade at the base; style-crests triangular, revolute. Probably from Sikkim.

SUBGENUS REGELIA.

A. *Rhizomes wide-spreading, stoloniferous*..36. **stolonifera**
AA. *Rhizomes compact.*
B. *Lvs. ensiform: outer segms. suddenly contracted into a claw*.....37. **Korolkowi**
BB. *Lvs. linear: outer segms. gradually narrowed to a claw*.....38. **darwasica**

36. **stolonífera,** Maxim. (*I. Leichtlinii*, Regel. *I. vàga*, Foster). Rhizome slender, wide-creeping: lvs. in tufts, not contiguous, ensiform, 1–1½ ft. long, scarcely glaucous: st. 1–2 ft. long, almost wholly concealed by clasping lvs., 1-headed, bearing 2–3 fls.: outer segms. 2–2½ in. long, oblong-cuneate, bright lilac, suffused with bronze toward the margin, with a yellow beard; inner segms. oblong, as broad as the outer, claw also bearded. Turkestan. Gn. 52:222. B.M. 7861. Gt. 36:1244 (rootstock only). G.C. III. 32:242. Gn.W. 24:382. Var. **vàga,** Foster, has larger fls.

37. **Korólkowi,** Regel. Rhizome short-creeping: lvs. glaucous, 1 ft. long: st. 1 ft. long, bearing 2–3 reduced lvs. and a single head of 2–3 fls.: spathe-valves 2–3 in. long, keeled, acuminate, green flushed with purple: limb 2½–3 in. long, pale yellowish white, veined with red-brown in the type; outer segms. oblong, 1 in. broad, with a brown beard and a brown patch on the throat; inner segms. as large, erect. May. Turkestan. B.M. 7025. Gn. 28:484. G.C. III. 4:37. Gt. 22:766; 40: 1358.—Very hardy. One of the earliest. Variously colored lilac, and so on in cult. Var. **cóncolor,** Foster. Purplish lilac, veined darker. Var. **Leichtliniàna,** Foster. Creamy white, with brownish veins. Var. **violàcea,** Foster. Violet, with dark veins.

38. **darwásica,** Regel (*I. Suwórowi*, Regel. *I. lineàta*, Foster). Lvs. thin, linear, 1 ft. long, ½in. wide, very glaucous, bluish green: st. 1 ft. high, bearing 2–3 reduced lvs. and a single head of fls.: spathe-valves 3–3½ in. long, green or slightly flushed with purple, sharply keeled and very pointed, longer than the tube: outer segms. oblong-cuneate, ½in. broad, 2 in. long, closely veined with oblique lines of claret-purple on a greenish yellow ground; beard blue; inner segms. oblong, with a long claw, often faintly bearded, veined and tinted on the margins with claret-purple. Bokhara. B.M. 7029. Gt. 36:1244.

SUBGENUS ONCOCYCLUS.

A. *Outer segms. of the perianth ligulate, much reduced*.....39. **paradoxa**
AA. *Outer segms. of the perianth not much smaller than the inner.*
B. *Lvs. linear, narrow, not over ½in. wide, more or less falcate: plant slender: st. usually not over 6–8 in. high.*
C. *The outer segms. deflexed from the base, very concave*.....40. **iberica**
CC. *The outer segms. deflexed from the middle, convex.*
D. *Fls. uniformly colored, not conspicuously veined,*
E. *Signal patch darker, but of the same color as the outer segms.*
F. *Color of fls. yellow*.....41. **urmiensis**
FF. *Color of fls. reddish purple*.42. **Barnumæ**
FFF. *Color of fls. lilac*.....43. **Mariæ**
EE. *Signal patch not of the same color as the outer segms.; fls. purplish black*.....44. **atropurpurea**
DD. *Fls. conspicuously veined on a ground of different color.*
E. *Outer segms. obovate-cuneate*.45. **Saarii**
EE. *Outer segms. lanceolate pointed*.....46. **Ewbankiana**
BB. *Lvs. ensiform or linear, over ½in. broad, scarcely falcate: plant larger, stout: st. usually a foot or more high.*
C. *Inner and outer segms. similarly colored.*
D. *Fls. light-colored gray or lilac.*
E. *Outer segms. marked with numerous fine purple veins and sprinkled with minute purplish dots more crowded on the throat; fls. very large*..47. **Gatesii**
EE. *Outer segms. dotted and veined with crimson or reddish brown, with a reddish patch at the throat;; fls. smaller*.....48. **Lortetii**
DD. *Fls. dark-colored, mostly brownish or purple.*
E. *Segms. almost uniformly dark purple*.....49. **atrofusca**
EE. *Segms. heavily veined and spotted with black-brown on a lighter ground*.....50. **susiana**
CC. *Inner segms. blue to pale blue; outer segms. densely spotted and veined with purple-brown*.....51. **Bismarckiana**

39. **paradóxa,** Stev. Plants dwarf: lvs. linear, 3–6 in. long: st. 2–6 in. high: fl. large; outer segms. reduced to a mere claw, dark, covered with a dense pile; inner segms. 2 in. long, orbicular, lilac to white. Mountains of Ga. and N. Persia. B.M. 7081. Gn. 32:584; 46, p. 173; 59, p. 248 (var. *choschab*). Gt. 386. G.C. III. 29:104 (var. *choschab*).—A fl. with singular combinations of color. Grows in dry situations, but requires shelter in winter. Long cult., but not common.

40. **ibèrica,** Hoffm. Dwarf, with a large fl.: lvs. 3–6 in. long, narrow, very falcate: st. 3–4 in. long: outer segms. rounded-obovate, 2 in. broad, pale brown, closely veined and blotched with purple-brown and with a shining dark patch on the throat; inner segms.

connivent, pure white, faintly veined, with a few wine-red spots at base. Caucasus and mountains of Armenia and Persia. B.M. 5847. Gt. 386 and 713. F.S. 19: 1963. R.H. 1873: 370. Gn. 10:526; 43, p. 131; 72, p. 349. I.H. 19:106. G.C. II. 11:693; III. 53:399. F. 1873:25. F.M. 1875:168.—Hardy. The color of the fls. varies considerably in this species. In some the inner segms. are nearly white, while in others they are nearly as dark as the outer. The species is chiefly distinguished by the curious spoon-shaped concave outer segms. and the depressed style-branches which give the fls. an appearance different from the other members of this group.

41. **urmiénsis,** Hoog (*I. chrysántha*, Baker). Rhizome short-creeping: lvs. linear, 1 ft. long, thick and firm, glaucescent with a pale margin: st. slender, as long as the lvs.: spathe-valves lanceolate-acuminate, 4 in. long, pale green, chartaceous: fls. pale yellow; outer segms. oblong, emarginate, 3 in. long, reflexed from near the base, with a bright orange beard; inner segms. erect, obovate-cuneate, as long as the outer and broader; style-branches yellow, an inch broad, with large quadrate entire crests. Probably near Lake Urumiah in N. W. Persia. B.M. 7784. Gn. 58, p. 375. G.C. III. 28:373.

1969. Type of oncocyclus iris—Iris susiana. Example of diffusely bearded flower. (×⅓)

42. **Bárnumæ,** Baker & Foster. Lvs. about 5–6 in a tuft, slender, linear, about 6 in. long, less than ⅛in. broad: st. 2–6 in. long, bearing a single sheathing lf.: spathe-valves 2 in. long, green with purple tips and margins: outer segms. obovate-cuneate, reflexed, 2 in. long, 1 in. broad, passing into a cuneate claw, dark reddish purple with darker veins and a triangular beard of yellow purple-tipped hairs; inner segms. obovate-orbicular, connivent, 3 in. long, 2½ in. broad, suddenly contracted into a short claw, reddish purple, lighter than the outer segms. and with more conspicuous veins and few scattered hairs on the claw. Mountains of Armenia. B.M. 7050.

43. **Màriæ,** Barbey (*I. Hélenæ*, Barbey). Lvs. very falcate, 3–4 in. long: st. 3–6 in. long, with 2–4 short lvs.: limb pale lilac, with fine red-brown veins; outer segms. orbicular, 2½ in. long, with a dark purple patch at the throat; inner segms. larger, more rounded. Desert between Egypt and Palestine. Discovered 1880. Gt. 42, p. 488; suppl. pl. J.H. III. 28:302. G.M. 37:215.

44. **atropurpùrea,** Baker (*I. Éggeri*, Hort.). Lvs. 6 in. long: st. 6–8 in.: outer segms. oblong, 2 in. long, purplish black, without veins, with a yellow patch on the throat and a beard of yellow, black-tipped hairs; inner segms. larger, of the same color, with discernable veins; style-crests small. Easily distinguished by its rather small, uniformly colored fls. Gt. 40:1361; 42, p. 489; suppl. pl.

45. **Saàrii,** Schott (*I. Sàri*, Aut. *I. lupìna*, Foster). Rhizome short, stout: lvs. about 6 in. long, finally 1 ft., linear-complicate: st. 3–6 in. long, with 2 reduced lanceolate lvs.: pedicel very short: fls. bright lilac, large as in *I. susiana;* tube 1 in. long; outer segms. obovate-cuneate, 1½–2 in. broad, reflexed from half way down; inner segms. oblong, with a short claw. Very near *I. iberica*, from which it differs chiefly by its bright lilac fls. Asia Minor. B.M. 7904. G.C. III. 36:147. Var. **lùrida,** Boiss. Segms. brownish white with many brown-black spots near the center, and numerous brownish lines toward the margin, the outer with a brown-black spot at the throat. Gn. 43:130; 54, p. 59.

46. **Ewbankiàna,** Foster (*I. Sprèngeri*, Siehe). Rhizome slender, similar to that of *I. iberica:* lvs. 6–8 in. long, glaucous, very narrow and somewhat falcate: st. 2–4 in. high, bearing 2–3 reduced lvs.: spathe 1-fld., 2¼ in. long; valves narrow, inflated, green: outer segms. lanceolate, pointed, horizontally extended, not recurved, creamy or grayish white, marked with conspicuous, irregular, jagged, purple-brown veins, with a purplish black patch at the throat; beard of stout yellow hairs tipped with brown; inner segms. ovate-lanceolate colored like the outer and marked with jagged brown-purple veins which become more broken on the claw; style-branches almost uniform chocolate-brown. Mountains of Persia and Transcaucasia. R.H. 1901, p. 399. Gn. 70, p. 15. G.C. III. 29:407; 36:50. —The venation, together with the ground-color, gives the fls. at a distance a uniform gray tone. Not particularly beautiful.

47. **Gàtesii,** Foster. Habit and foliage of *I. susiana:* outer segms. orbicular, 3–5 in. broad, cream-white, sometimes sky-blue, covered with a network of fine veins, giving them a light gray tint; inner segms. larger, pale purple or yellow. Dry regions, Armenia. B.M. 7867. Gn. 43:130 and p. 131; 52, pp. 88, 279; 72, p. 422. G.C. III. 8:17. A.G. 13:60. G. 20:299.—The largest-fld. of its subgenus. Fls. about twice as large as in *I. susiana*. Quite hardy.

48. **Lortétii,** Barbey. Lvs. less than 1 ft. long: st. about 1 ft. high, bearing 2 reduced lvs.: spathe-valves 5 in. long, green or slightly scarious above: outer segms. obovate, much reflexed, 3 in. broad, whitish, finely veined and spotted with red-brown, with a dark spot at the throat; inner segms. orbicular, connivent, pale gray, with red-brown veins. Lebanon. B.M. 7251. Gn. 43:130; 48, p. 337. Gt. 42, p. 490. G.C. III. 12: 153. G.M. 36:386; 40:250. R.H. 1902, p. 404. R.B. 32: 173.—Quite hardy N.

49. **atrofúsca,** Baker (*I. atropurpùrea* var. *atrofúsca*, Baker. *I. Hàymei*, Mallett). Lvs. pale green, 1 ft. long: st. 1 ft. long, hidden by the sheathing inner lvs.: limb dark purple-brown; outer segms. obovate, 3 in. long, with a dark spot on the throat; inner segms. larger and broader; style-branches very convex; crests large. Palestine. B.M. 7379. Gn. 48, p. 8; 50:332 and p. 333. Gt. 42, p. 488; suppl. pl. Gn. W. 24:399. J.H. III. 48:361. G.M. 47:258.

50. **susiàna,** Linn. Mourning Iris. Fig. 1969. Lvs. very glaucous, 6–9 in. long, nearly 1 in. broad: outer segms. obovate, 3 in. long, brownish purple, veined and spotted with black-brown, with a brown beard; inner segms. brownish white, spotted with violet-brown and black. Asia Minor and Persia. B.M. 91. F.S. 11:1087, 1088. R.H. 1859, pp. 322, 323. Gn. 32, p. 193; 39:340; 66, p. 173(?). G. 1:136, 264; 33:203. G.C. III. 51:20. Gn.M. 10:120. Gn.W. 23:426, suppl. A.F. 16:1375.—The best known of

LIX. Japanese irises.—Iris lævigata.

this group. Said to have been intro. from Constantinople in 1753. Name from a city in Persia. Not entirely hardy N., but a good pot-plant. Var. **màjor**, Hort. Bluish, tinted brown.

51. **Bismarckiàna,** Damman (*I. nazarèna*, Hort. *I. Sàri* var. *nazarèna*, Foster). Habit of *I. susiana*, and fls. as large: lvs. 8 in. long: st. 12–18 in. high: outer segms. orbicular, yellowish, densely spotted with purple-brown, with a dark purple-brown spot at the end of the beard; inner segms. orbicular, short-clawed, sky-blue from numerous blue veins on a creamy white ground. N. Palestine. B.M. 6960 (as *I. Sari* var. *lurida*); 7986. R.H. 1902, p. 405. J.H. III. 56, p. 497 (as *I. Sari* var. *nazarensis*). I.H. 42, p. 78(?). Gt. 42, p. 487; suppl. pl. G.M. 40:250.

SUBGENUS PARDANTHOPSIS.

52. **dichótoma,** Pall. Rhizome slender: lvs. 6–8 in a fan-shaped cluster, 8–12 in. long, 1½ in. wide: st. 2 ft. high, much branched, bearing 6–10 heads: spathes not over ½in. long, scarious, 3–5-fld.: fls. fugitive, opening only in the afternoon, twisting spirally when withering; outer segms. with a subquadrate blade contracted into a broadly cuneate claw, whitish, spotted with lilac-purple; inner segms. spreading, oblong-unguiculate, whitish and light purple. August. Irkutsk and Transbaikalia to Manchuria and China. B.M. 6428. B.R. 246.—Although the fls. last only a few hours, they are produced in great profusion so that usually 4–6 are open at the same time.

SUBGENUS APOGON.

A. *Lvs. linear, generally less than ½in. broad.*
  B. *Lf.-sheaths splitting into fibers.*
    C. *Spathe-valves green.*
      D. *Tube of the perianth evident, usually more than ½in. long.*
        E. *St. with 1–2 long lvs. immediately below the spathe*....53. **humilis**
        EE. *St. bearing a reduced lf. and springing from a pair of reduced lvs. at the base*.....54. **ruthenica**
        EEE. *St. sheathed by 1–2 narrow reduced lvs*.....55. **macrosiphon**
      DD. *Tube of the perianth short or obsolete, usually less than ½in. long.*
        E. *Fls. yellow.*
          F. *St. wiry, with a single sheathing lf. low down*.....56. **Hartwegii**
          FF. *St. slender, bearing 2 lanceolate sheathing lvs*....57. **Grant-Duffii**
          FFF. *St. hollow, bearing a much-reduced lf. near the middle*.....58. **Wilsonii**
        EE. *Fls. some shade of blue or white.*
          F. *St.-lvs. long, usually over 1 ft. and exceeding the st.*..59. **graminea**
          FF. *St.-lvs. reduced.*
            G. *Rhizome slender: lvs. pink at base*.....60. **tenax**
            GG. *Rhizome stout, compact.*
              H. *Caps. long, narrow*...61. **ensata**
              HH. *Caps. fusiform tapering at both ends*.....62. **longipetala**
    CC. *Spathe-valves scarious only in the upper part or along the edges.*
      D. *Inner segms. suberect, extended obliquely*.....63. **Delavayi**
      DD. *Inner segms. erect, connivent*....64. **sanguinea**
    CCC. *Spathe-valves entirely scarious.*
      D. *St. hollow*.....65. **sibirica**
      DD. *St. solid*.....66. **prismatica**
  BB. *Lf.-sheaths not splitting into fibers.*
    C. *St. nearly obsolete*.....67. **unguicularis**
    CC. *St. present; clothed with sheathing bracts.*
      D. *Perianth-tube short, funnel-form*.....68. **bracteata**
      DD. *Perianth-tube slender, as long as the ovary*.....69. **Sintenisii**
    CCC. *St. present, bearing 1–2 lvs.*
      D. *The lvs. purplish at base: st. scarcely overtopping the lvs*...70. **Douglasiana**
      DD. *The lvs. not purplish at base: st. much exceeding the lvs*.....71. **missouriensis**
AA. *Lvs. ensiform, generally much over ½in. broad.*
  B. *Plants large.*
    C. *St. bearing several long lvs.*
      D. *Fls. reddish brown*.....72. **fulva**
      DD. *Fls. yellow*.....73. **Pseudacorus**
      DDD. *Fls. blue, purple, or lilac to white.*
        E. *Inner segms. at least half as long as the outer.*
          F. *The lvs. somewhat glaucous* 74. **vesicolor**
          FF. *The lvs. green, not glaucous.*
            G. *Outer segms. 3–4 in. long; fls. sessile*.....75. **hexagona**
            GG. *Outer segms. 2½–3 in. long; fls. pedicelled*....76. **caroliniana**
        EE. *Inner segms. minute, setose*..77. **setosa**
    CC. *St. bearing 2–4 reduced lvs.*
      D. *Fls. yellow.*
        E. *Outer segms. with an orbicular blade.*
          F. *Plants tall, 2–3 ft. or more: fls. without veins or spots.*78. **Monnieri**
          FF. *Plants smaller, scarcely exceeding 1½ ft.: outer segms. faintly veined on the claw*.....79. **halophila**
        EE. *Outer segms. with an obovate blade; fls. white and pale yellow*.....80. **orientalis**
        EEE. *Outer segms. with an oblong blade; fls. golden yellow*....81. **aurea**
      DD. *Fls. blue, purple, lilac or white.*
        E. *Seeds orange-red or scarlet: fls. inconspicuous*.....82. **fœtidissima**
        EE. *Seeds brown: fls. showy.*
          F. *Sts. bearing several lateral spicate heads below the terminal one*.....83. **spuria**
          FF. *Sts. bearing a terminal head and often a stalked lateral head*.....84. **lævigata**
  BB. *Plants dwarf*.....85. **verna**

53. **hùmilis,** M. Bieb. (*I. ruthénica*, Ker ex parte). Rhizome wide-creeping: lvs. linear, up to 12 in a tuft, glaucous, 6–12 in. long: st. not more than 1–1½ in. long, bearing 2 long lvs. immediately below the spathes: spathe 1-fld.; outer segms. with a suborbicular blade and a long cuneate claw, deep blue-purple with deeper veins, whitish on the throat, with deep purple veins; inner segms. oblanceolate, unguiculate, blue-purple. Caucasus to Georgia and Hungary. Gn. 10, p. 379. —Distinguished from *I. ruthenica* by the 2 long lvs. which arise below the spathe and are 2–3 times as long as the latter.

54. **ruthénica,** Ker. Lvs. linear, in crowded tufts, 6 in. long at flowering-time, becoming 12 in. long: st. slender, 1–8 in. long, but often obsolete; 1-headed: pedicel ¼–2 in. long: tube twice as long as the ovary; outer segms. with an oblong blade rather shorter than the claw, lilac, veined and dotted with bluish purple on a whitish ground near the center and lower part of the blade; inner segms. lanceolate, with narrow claws, deep purple-violet. April, May. China, Siberia and Cent. Asia. B.M. 1123, 1393. Gn. 50, p. 187. G.W. 15:132.—Violet-scented.

55. **macrosìphon.** Torr. Plants rather dwarf, 6–12 in. high: lvs. grass-like, green, 12 in. long, exceeding the fls.: st. 3–6 in. long: pedicels very short: tube 1½–3 in. long; outer segms. obovate-cuneate, undulate, pale yellow to cream, with a network of brownish crimson or bright lilac veins; inner segms. rather small, colored like the outer. Free-flowering. Calif. and Ore. Gn. 52, p. 126. —Torrey says the fls. are bright lilac and the lvs. less than 4 lines wide. The color varies from white to cream-yellow and purple.

56. **Hártwegii,** Baker. Lvs. few (2), 6–12 in. long, finely veined: st. 6 in. long, with a linear lf. low down: pedicel 1–1½ in. long: limb pale yellow; outer segms. with an oblong blade, shorter than the claw. Calif. —Rarely cult.

57. **Grant-Dúffii,** Baker (*I. Áschersonii,* Foster). Lvs. about 1 ft. long: st. 6 in. high, with about 2 lvs., 1-headed: outer segms. with a yellow blade, much shorter than the claw; claw veined with lilac on a yellowish white ground. Palestine. B. M. 7604. Gn. 61, p. 288. Gt. 42; suppl. pl.—Not valuable commercially.

58. **Wílsonii,** Wright. Plants tall, growing in clumps like *I. sibírica* and throwing up clusters of fl.-sts.: lvs. linear-ensiform, 2 ft. long and ½in. broad, slightly glaucous, drooping above: st. about as long as the lvs., 2- or 1-fld., bearing a small lf. at the middle: spathes somewhat herbaceous, 2½–4 in. long: pedicels triangular, 1–5 in. long: outer segms. 2 in. long, ¾in. wide, oblong or obovate-elliptic, pale yellow, veined and dotted with purple on the throat, and on the broad claw; inner segms. oblong-lanceolate, narrowed to a slender claw, pale yellow, mottled with reddish brown at the edges. W. China.—A tall yellow form suitable for cult. with the blue and the white forms of *I. sibírica.*

59. **gramínea,** Linn. (*I. nikiténsis,* Lange). Lvs. linear, 15–36 in. long, strongly ribbed: st. compressed, angled, slender, solid: pedicel 1–1½ in. long: limb bright lilac, copiously veined; outer segms. with an orbicular blade ½in. broad and shorter than the broad claw; claw dull yellow, veined with purple; inner segms. erect, nearly straight. May. Cent. and S. Eu. B.M. 681.—Long cult.; mentioned by Lobel, Clusius and Gerarde. Distinguished from *I. sibírica* by its solid, angular st.

1970. Iris unguicularis. Type of smooth-petaled iris (×⅓). No. 67

60. **tènax,** Douglas. Sheaths short: lvs. 6–12 in. long: st. 6–12 in. long: pedicel ½–2 in. long: outer segm. broadly obovate, with an acute point; blade about as long as the claw, bright lilac, with purple veins and a variegated white and yellow spot on the throat; inner segms. shorter, waved. April, May. Dry soils, Brit. Col. and Ore. Intro. to England 1826. B.M. 3343. B.R. 1218. Gn. 53:518. G.M. 50:867.—Hardy.

61. **ensàta,** Thunb. (*I. gramínea,* Thunb. *I. biglùmis,* Vahl. *I. hæmatophýlla,* Link. *I. Pállasii,* Fisch. *I. longispàtha,* Fisch. *I. oxypétala,* C. A. Mey. *I. frágrans,* Lindl.). Sheaths large: lvs. 1–3 ft. long: st. 2–12 in. long, flattened, bearing a single terminal head: pedicel 2–4 in., often longer than the spathe: limb loose, bright blue or lilac; outer segms. oblanceolate, 2 in. long; blade shorter than the claw, veined with dark blue, yellowish on the throat; inner segms. slender, erect, bright blue. Russia, Japan, Caucasus. B. M. 2331, 2528. B.R. 26:1. Gt. 1011.—Hardy. Variable. Var. **pabulària,** Naudin (*I. pabulària,* Hort.). Said to be distinct. Larger, with lvs. purplish red near the base. Used as a forage plant. Does well in driest situations. Gt. 47:1452. Described by Wittmack, Gt. 47, p. 369. The seeds should be sown in beds, and the young plants set out the following spring, 10 in. apart each way, where they are to remain.

62. **longipétala,** Herb. Lvs. 1–1½ ft. long, narrow, ensiform: st. stout, solid, compressed, 1½ ft. high: fls. bright lilac; outer segms. obovate, reflexing half way down; claw veined with violet on a white ground. Calif. B.M. 5298.

63. **Delavàyi,** Mich. Lvs. 2–2½ ft. long, often nearly 1 in. broad: st. 3–5 ft. high, bifurcate: spathe-valves green: outer segms. reflexed from the middle, oblong, obtuse or emarginate, brilliant violet, spotted with white on the lower half; claw yellow, veined with lilac; inner segms. oblong-lanceolate, acute, erect, violet. Thibet. B.M. 7661. R.H. 1895, p. 399. —Large plants, with the fl.-stalks erect, high above the lvs.

64. **sanguínea,** Donn (*I. orientàlis,* Thunb. *I. sibírica* var. *sanguínea,* Ker. *I. nertschínskia,* Lodd. *I. hæmatophýlla,* Fisch. *I. sibírica* var. *orientàlis,* Baker). Lvs. linear, glaucous, often tinged with red-purple at base, 18 in. long and ⅓–½in. broad: st. about as long as the lvs., bearing a terminal head of 2–3 fls. and rarely a lateral head: spathes slightly scarious at flowering time, often reddish purple: outer segms. with a small orbicular blade, narrowed abruptly to a short claw, bright lilac, yellowish white at the throat, veined with purple; inner segms. broadly oval, connivent, dark blue. Manchuria. Korea, and Japan. B.M. 160 L.B.C. 19: 1843.—Often regarded as a variety of the Cent. European *I. sibírica,* which has short subglobose caps. and fls. raised high above the lvs., while *I. sanguínea* has longer trigonal caps. with fls. borne among the lvs.

65. **sibírica,** Linn. (*I. acùta,* Willd.). Compact, tufted: lvs. green, not rigid, 1–2 ft. long: st. slender, terete, fistulose, much overtopping the lvs., simple or forked, bearing several clusters of fls.: spathe small, narrow, acute, entirely scarious at flowering-time: limb bright lilac-blue; outer segms. 1½–2 in. long, with an orbicular blade gradually narrowed to a slender claw, veined with bright violet, whitish toward the claw; inner segms. shorter, erect. Cent. and S. Eu. and E. Siberia. Intro. in 1796. B.M. 50. R.H. 1898,

p. 23. G.W. 12:678. Gn.M. 15:362.—Common in cult. The plants form large, compact clumps, producing many long flowering sts. from the center. Each st. usually has a terminal cluster of 2–5 fls. and 1 lateral head. Var. **variegàta**, Hort., has variegated lvs. Var. **acûta**, Hort. Narrow-lvd. Var. **flexuòsa**, Murray (*I. flexuòsa*, Murray. *I. sibírica* var. *álba*, Hort.). Fls. white with crisped segms. B.M. 1163.

1971. Iris bracteata. (×½)

66. **prismática**, Pursh (*I. grácilis*, Bigel. *I. virgínica*, Muhl.). Plant tall, slender: lvs. mostly shorter than the st., grass-like: st. 1–2 ft., simple or forked, flexuous: spathes 1–2-fld.: pedicel long, exceeding the spathe: outer segms. 1½–2 in. long; blade shorter than the claw, bright lilac, yellow on the throat, marked with purple and darker veins; inner segms. erect, bright lilac. May, June. Wet grounds, New Bruns. to Pa. and N. C. B. M. 1504.

67. **unguiculàris**, Poir. (*I. stylòsa*, Desf. *I. creténsis*, Janka). Fig. 1970. Lvs. about 6 in a tuft, finally 1½–2 ft. long, bright green: st. nearly obsolete: spathes 2–3-fld.; valves 4–6 in. long, scarious at the tip only, shorter than the tube: tube 5–6 in. long, filiform, exserted from the spathe; limb bright lilac, rarely white; outer segms. 2½–3 in. long, 1 in. broad, with a yellow keel, streaked with lilac on a white ground at the throat; inner segms. oblong. Jan., Feb. Algeria, Greece and Islands, Asia Minor and N. Smyrna. B.M. 5773; 6343. R.H. 1900:300. Gn. 24:68; 46:248; 49, p. 236; 50, p. 187. G.C. III. 25:85. F.S.R. 35, p. 131. G. 9:590; 34:115. G.L. 19:48; 22:378. Gn. W. 20:159.—Not hardy, but useful for cutting in early winter. Fragrant. Var. **álba**, Hort. White form; spring. C.L.A. 5:134. Gn. 68, p. 381. Var. **supérba**, Hort. Bluish purple. Oct. and later. Var. **speciòsa**, Hort. Fls. well above the foliage, deep reddish purple.

68. **bracteàta**, Wats. Fig. 1971. Rudimentary lvs. brown, very rigid; produced lvs. 1 to few, much exceeding the st., 1–2 ft. long, one side green, the other glaucous, edge revolute: st. 1-headed, angled, 2–3 in. to 1 ft. long, sheathed with bracts 2–4 in. long: tube short, funnelform; outer segms. 2–3 in.; blade ovate, as long as the claw, pale yellow, veined with bluish purple; inner segms. shorter, erect, yellow; style-branches long, narrow. June. Discovered in 1884 by Thomas Howell, in Ore. G.F. 1:43 (adapted in Fig. 1971). G.C. III. 39:401; 52:338. G.M. 50:161.—Intro. 1888.

69. **Síntenisii**, Janka (*I. graminea* var. *Síntenisii*, Richter. *I. Urúmovi*, Velenovski). Lvs. narrow, linear, acuminate, 8–18 in. long, ¼–½ in. broad: st. round, not flattened as in *I. graminea*, slender and flexuous, 4–12 in. long, almost entirely clothed by 2–3 reduced lvs. and bearing a single head of 2 fls.: spathe-valves narrow, linear, acuminate, keeled, the inner longer than the outer: ovary tapering to a long neck taking the place of the perianth-tube: fls. bright lilac, 1½ in. long; outer segms. with an obovate blade and a slightly pandurate claw, bluish purple, whitish toward the throat, marked with purple veins and with reddish purple veins on the claw; inner segms. oblanceolate with a cuneate claw deep blue-purple; style-crests lanceolate. S. Italy, Balkan Peninsula, Asia Minor and Turkey.

70. **Douglasiàna**, Herb. Rhizome stout, short, creeping: lvs. about 6 in a tuft, broadest in the middle, strongly ribbed, 1–2 ft. long: st. 1–2 ft. high, usually simple, with 1 long bract-lf.: tube ½–¾ in. long: fls. 3–4 in. diam.; outer segms. obovate-spatulate, spreading and recurved, pale lilac, with a white disk and purple veins; inner segms. shorter, erect, lanceolate, acuminate, pale lilac, veined. Calif. B.M. 6083. Gn. 50: 272.—Exists in an endless variety of color-forms, varying from pale lilac to deep violet with considerable variation in the veining.

71. **missouriénsis**, Nutt. (*I. Tolmiàna*, Herb.). Lvs. pale green, finely ribbed, 1–1½ ft. long: st. 1–2 ft. long, usually exceeding the lvs., bearing a single large lf. low down: pedicel long: tube very short; limb bright lilac; outer segms. obovate, 1 in. broad, yellow near the claw; inner segms. oblong, emarginate, straight, erect. Wet soil. S. D. and Mont. to Ariz. B.M. 6579. Gn. 50:186.—Not common in cult. Flowers early.

72. **fúlva**, Ker (*I. cùprea*, Pursh). Lvs. thin, bright green, 1½–2 ft. long, not exceeding the st.: st. 2–3 ft. high, forked low down; lower st.-lvs. 1 ft. long: pedicel produced: tube greenish yellow, 1 in. long; limb loosely expanded, bright reddish brown or copper-colored, variegated with blue and green; outer segms. obovate-cuneate, emarginate; inner segms. smaller, spreading. Late June. In swamps, Ill. to Ga., La. and Texas. Intro. into England 1811 by Lyon. B.M. 1496. Gn. 53:518. Mn. 5:61.

73. **Pseudácorus**, Linn. (*I. acoroìdes*, Spach. *I. flàva*, Tornab.). Lvs. 1½–3 ft. long, equaling the st.: st. stout, terete, 2–3 ft., bearing several long lvs. and several clusters of fls.: limb bright yellow; outer segms. broadly obovate, 2–2½ in. long, yellow, with a bright spot and radiating brown veins on the claw; inner segms. scarcely longer than the claw of the outer, oblong. May, June. Eu., Syria and the Barbary states; naturalized in N. Y., Mass. and N. J.—The plants

1972. Iris versicolor (×½). No. 74

form fine, large clumps, bearing numerous flowering stalks. Var. **variegàta,** Hort. Lvs. striped with creamy white. Var. **pállida,** Hort. Fls. pale sulfur-yellow.

74. **versícolor,** Linn. (*I. virgínica,* Linn.). Fig. 1972. Lvs. slightly glaucous, 1½–2 ft. long: st. forked low down and often branched above, 2–3-headed: tube very short; limb violet-blue; outer segms. spatulate, 2–3 in. long, variegated with yellow on the claw and veined with purple; inner segms. oblanceolate, much smaller. British N. Amer. and N. U. S. Intro. into England 1732. B.M. 21, 703.

75. **hexagòna,** Walt. Lvs. 2–3 ft. long: st. usually simple, 3 ft. long, 2–3-headed, with several large lvs., the upper ones exceeding the fls.: spathe-valves sometimes lf.-like: tube 1 in. long, green, dilated upward; limb bright lilac; outer segms. 3 in. long; blade obovate, with a bright yellow keel on the claw; claw downy; inner segms. shorter, erect; style-branches very concave, green, with a central lilac band. Ky. to Texas. and Fla. B.M. 6787.

76. **caroliniàna,** Wats. Fig. 1973. Lvs. 2–3 ft. long, bright green: st. stout, simple or branched: tube ½in. long; limb lilac, variegated with purple and brown; outer segms. broadly spatulate, 2½–3 in. long, with narrow claws; inner segms. narrower, nearly erect. Differs from *I. versicolor* by its green lvs. Discovered by W. A. Manda in N. C. B.M. 8465. G.F. 6:335 (adapted in Fig. 1973).

77. **setòsa,** Pall. (*I. brachycúspis,* Fisch. *I. tripétala,* Hook.). Lvs. thin, green, 1–1½ ft. long: st. deeply forked, much exceeding the lvs.: tube ¼in. long; limb bright lilac; outer segms. 2–2½ in. long; blade 1 in. broad, suddenly narrowed at the claw, copiously veined; inner segms. very small, ½in., cuneate, large-cuspidate; style-branches large, crested. E. Siberia, Japan, and N. W. Amer. to Labrador and Maine. B.M. 2326; 2886. Gt. 322.

78. **Monnièri,** DC. Lvs. slightly glaucous, 2–3 ft. long: st. stout, terete, 3–4 ft. long, with several sessile clusters of fls.: limb 2½–3½ in. long, lemon-yellow, without veins; blade of outer segms. orbicular, 1–1½ in. long, equaling the claw; inner segms. oblong-unguiculate, 1 in. broad. Origin not certainly known. Found in the garden of Lemonnier at Versailles. G. 25:389.—Not showy except in masses. This and *I. orientalis* and *I. aurea* are very closely related and together with *I. halophila* are perhaps all forms of *I. spuria. I. Monnieri* is uniformly bright lemon-yellow, free from veins or spots. By its coloring, it differs from *I. orientalis* and by the orbicular blade of the outer segms. from *I. aurea,* in which the blades are oblong. Often attributed to Crete.

1973. Iris caroliniana. (×½)

79. **halóphila,** Pall. (*I. Gueldenstædtiàna,* Lepech.). Lvs. pale green, 1–1½ ft. long: st. stout, terete, 1½–2 ft. long, often bearing 1–2 spicate clusters below the end one: limb pale yellow; outer segms. with an orbicular blade ½–¾in. broad, shorter than the claw, which has a bright yellow keel and faint lilac veins; inner segms. shorter, erect. Asia. B.M. 1515 (*I. spuria* var. *stenogyna,* Ker).

80. **orientàlis,** Mill. (*I. ochroleùca,* Linn. *I. gigantèa,* Carr.). Fig. 1974. Plants growing in strong clumps: lvs. 2–3 ft. long, 1 in. or more broad, slightly glaucous: st. 3 ft., stout, terete, about as long as the lvs., with 2–3 spicate clusters of fls.: outer segms. obovate, 1 in. broad, as long as the claw, yellow, paler or white toward the margin; inner segms. oblong, 1 in. broad, lemon-yellow to whitish. Asia Minor and Syria. B.M. 61. Gn. 20:272; 38:462; 46, p. 362; 50, p. 186; 69, p. 25; 72, p. 622. Gn. M. 15:360. R.H. 1875, p. 357.—One of the largest of the irises. Grows in almost any situation. White forms of this plant are in cult. but no purple forms are known. See note under *I. Monnieri.*

1974. Habit sketch of Iris orientalis. (×$\frac{1}{15}$)

81. **aûrea,** Lindl. Lvs. scarcely glaucous, 1½–2 ft. long: st. 3–3½ ft. long, stout, terete, with 1–2 sessile lateral clusters below the end one: spathes 2–3-fld.: pedicel long: limb bright yellow; outer segms. with an oblong undulate blade 1 in. broad, as long as the claw; inner segms. less than ½in. broad, with much-waved edges. July. W. Himalayas. B.R. 33:59. Gn. 31:52. G. 25:388. B.M. 1131 (as *I. spuria* var. *halophila*).—Intro. by Dr. Royle. The color is a rich golden yellow, much deeper than that of *I. Monnieri* and the others of this group. See *I. Monnieri.* Said to grow up to 5 ft. high under favorable conditions. Var. **intermèdia,** W. I., in G.C. III. 28:22. Intermediate between *I. aurea* and *I. orientalis.* Deep yellow, with crisped segms. like *I. aurea,* but having the obovate outer segms. and narrow inner segms. of *I. orientalis.* Fls. late, with *I. aurea.*

82. **fœtidíssima,** Linn. GLADWIN. Lvs. 1–1½ ft. long: st. compressed, 2–3 ft. long, 2–3-headed: tube ½in. long; limb bright lilac; outer segms. 1½–2 in. long, with a suborbicular blade equaling the claw; inner segms. shorter, oblanceolate. Cent. and S. Eu., England, Afghanistan and Algeria. Gn. 47, p. 30. G. 19:543.—This plant is very distinct, and is easily recognized by the odor of the broken lvs. The caps. remain on the plants in winter, bursting open and displaying rows of orange-red berries. The fls. are rather inconspicuous. There is a whitish variety with brown veins, and a variety with white-striped lvs. A pale yellow form veined with green also occurs occasionally.

83. **spûria,** Linn. Lvs. firm, linear, glaucescent, 1 ft. long, longer after flowering: st. overtopping the lvs., bearing 1–3 spicate heads: pedicel shorter than the spathe: tube ½–¾in. long; limb bright lilac; outer segms. with an orbicular, spreading blade ½in. broad and half as long as the claw; claws broad, concave, lilac, with a yellow keel and purple veins; inner segms. shorter, straight, oblanceolate; style-crests small. Cent. and S. Eu. B.M. 58. Var. **nòtha,** Bieb. (*I. halóphila,* Ker). More robust: lvs. 1 in. broad: spathes larger:

st. 2–3 ft. high. Caucasus to Kashmir. B.M. 875.—Hardy. Var. **desertòrum**, Ker. Fls. pale lilac; claws of the segms. yellow. B.M. 1514. Var. **sogdiàna**, Bunge (*I. sogdiàna*, Bunge). A variety with gray-lilac fls.

84. **lævigàta**, Fisch. (*I. Kaémpferi*, Sieb. *I. dilopurpurea*, Baker). JAPANESE IRIS. Figs. 1975, 1976. Lvs. thin, ensiform, 1–1½ ft. long: st. much overtopping the

1975. Japanese iris.—I. lævigata.

lvs., obscurely angled, 1–3-headed: pedicel ½–2 in. long: tube short; limb blue, violet, etc., sometimes white, spreading, 3–5 in. across; outer segms. broadly ovate-oblong, obtuse; with a yellow spot on the claw; claw short, distinct; inner segms. oblanceolate, erect, conniving or spreading; style-branches with bifid, incurved lobes. E. Siberia and Japan. Intro. by Von Siebold, and flowered at Ghent in 1857. B.M. 6132; 7511. I.H. 5:157. F.S. 20:2073, 2074; 23:2431–6. Gt. 442; 29:1003. Gn. 9:476; 16:198; 21:424; 55, p. 105; 60, p. 349; 74, pp. 336, 363, 365; 75:226. R.H. 1890, p. 188. G.C. II. 2:47; III. 13:165, 169; 14:501; 44:141. A.G. 19:596. Gng. 1:256; 5:163; 6:339; 7:145. J.H. III. 28:205. F.E. 10:777. F.M. 1874:137; 1880:403. G.W. 2:66; 12:220 (var. *alba*). Gn.M. 5:343; 15:361. C.L.A. 3:179. G. 19: 195. R.B. 36:245 (as *I. japonica*). G.F. 1:259 (adapted in Fig. 1975).—On account of the presence of a prominent ridge, formed by one or more veins along the middle of the lvs. of *I. Kaempferi*, this species is sometimes considered as distinct from *I. lævigata*. If the species are distinct, the numerous cult. forms of Japanese irises are probably all derived from *I. Kaempferi* since, at least so far as available material from forms cult. in the U. S. shows, all have the prominent midrib on the lvs.

85. **vérna**, Linn. Dwarf, 6 in. high: rhizome wide-creeping: sheaths not splitting into fibers: lvs. linear, slightly glaucous, 3–8 in. long: st. scarcely any, 1-headed: tube slender, 1½ in. long; limb deep violet; outer segms. 1½ in. long, obovate, narrowed into a slender yellow, slightly pubescent claw; inner segms. erect, smaller, violet. Shade, Ohio, Ky., Va. and south. L.B.C. 19:1855. B.M. 8159.—An anomalous species with the habit of a pogoniris but lacking the beard.

SUBGENUS JUNO.

A. *St. very short or none.*
  B. *Lvs. very short at flowering-time.*
    C. *The lvs. hollow, tetragonous*.....86. **Danfordiæ**
    CC. *The lvs. linear complicate*.....87. **persica**
    CCC. *The lvs. lanceolate, falcate*.....88. **Rosenbachi-**
  BB. *Lvs. 3–9 in. long at flowering-time,* [**ana**
    lanceolate, falcate at base.
    C. *Fls. bright lilac: hairs on the outer segms. blunt*.....89. **alata**
    CC. *Fls. yellow; hairs on the outer segms. with globular tips*.....90. **palæstina**
AA. *St. 3–15 in. long, sometimes obscured by the crowded lvs.*
  B. *Lvs. with a distinct white horny margin.*
    C. *Plants dwarf: st. hidden by the crowded clasping lvs.*
      D. *Claw of the outer segms. winged.*
        E. *Fls. lavender or purple*.....91. **Willmottiana**
        EE. *Fls. yellow*.....92. **caucasica**
      DD. *Claw, of the outer segms. not winged*.....93. **Fosteriana**
    CC. *Plants tall, 1 ft. or more: internodes evident.*
      D. *Outer segms. gradually contracted into a claw*.....94. **cærulea**
      DD. *Outer segms. suddenly contracted into a claw*.....95. **warleyensis**
  BB. *Lvs. without a conspicuous white horny edge.*
    C. *Claw of the outer segms. winged.*
      D. *Fls. slaty lilac*.....96. **sindjarensis**
      DD. *Fls. smoky yellow*.....97. **fumosa**
    CC. *Claw of the outer segms. not winged*.....98. **orchioides**

86. **Dánfordiæ**, Boiss. (*I. Bórnmuelleri*, Hausskn.). Fl.-sts. 2–4 in. high: lvs. very short at flowering time finally a foot long: fls. bright yellow, 1½ in. diam.; outer segms. with an orbicular blade spotted with brown; claw cuneate; inner segms. reduced to minute, spreading, subulate teeth; style-crests large. Spring. Cilician Taurus. B.M. 7140. Gt. 39:1327. Gn. 37:462; 67, p. 89. G.C. III. 27:170.—Fragrant.

87. **pérsica**, Linn. Bulb ovoid: lvs. 4–5, 2–3 in. long, becoming 6 in. long after flowering time, with white obscurely ciliated edges: st. short, 1-headed: tube 2–3 in. long; limb pale lilac; outer segms. with an orbicular blade with a dark purple blotch, an orange keel, and purple lines and spots; claw auriculate; inner segms. small. Asia Minor and Persia. B.M. 1. Gn. 11, p. 207; 14:490; 33:558; 54, pp. 103, 470; 66:8. F.S. 10:1045. G.C. III. 7:577. R.H. 1912, p. 454.—Should

1976. Japanese iris.—Iris lævigata, better known as Iris Kaempferi. (×⅓)

be lifted in summer. Var. **purpùrea,** Dykes (*I. purpùrea,* Siehe). A bright purple variety. Fine. Var. **Sieheàna,** Dykes (*I. Sieheàna,* Lynch. *I. Haussknéchtii,* Siehe). Similar to var. *purpurea,* but with larger, silvery gray fls. marked with reddish purple. B.M. 8059. G.C. III. 35:251. Var. **stenophýlla,** Dykes (*I. stenophýlla* Haussk. & Siehe. *I. Heldreìchii,* Hort.). Fls. pale blue; outer segms. blackish blue at the tip, with spots of the same shade on the rest of the blade; keel yellow; crests of the style-branches nearly as large as the outer segms., suborbicular, crenate. Cilician Taurus. B.M. 7734. G.C. III. 27:171. Gn. 59, p. 225; 76, p. 132. F.S.R. 2:328. Var. **Taùri,** Dykes (*I. Taùri,* Siehe). Fls. bright violet-purple veined with white on the lower part of the blade and on the claw of the outer segms.; keel deep orange; inner segms. depressed, 3-lobed. B.M. 7793. G.C. III. 29: 191. Gn. 61, p. 93.

88. **Rosenbachiàna,** Regel. Lvs. 4–5, finally 6–8 in. long and 2 in. broad: st. short, 1–3-headed: outer segms. obovate-cuneate; blade reflexed, white at the tip, deep purple in the middle and creamy below, with a yellow

1977. Iris orchioides.—A good species for pots or the open. (×⅓)

keel and dark lilac veins; inner segms. spreading or reflexed, obovate, pale lilac. The color of the fls. is very variable. Mountains of Turkestan. B.M. 7135. Gt. 35:1227. Gn. 33:558 J.H. III. 28:189. G.C. III. 7:577. G.M. 34:171. C.L.A. 5:134; 9:410.

89. **alàta,** Poir. (*I. scorpioìdes,* Desf. *Xiphium planifòlium,* Mill.). Lvs. about 6, plane, 6–9 in. long: st. very short, 1–3-fld.: tube 4–6 in. long; outer segms. 3–4 in. long, obovate-cuneate, bright lilac, variegated with white, and having a yellow keel down the claw; inner segms. obovate-unguiculate, spreading from the base of the outer; style-crest large, laciniately toothed. Spain to Sicily and Algeria. B.M. 6352. B.R. 1876. Gt. 40:1351 (vars.). Gn. 10, p. 579; 54, p. 102. G.C. III. 45:52. G.M. 35:614. G. 1:665; 11:689; 35:55. Gn.W. 20:185.—Winter-flowering. Plants very dwarf.

90. **palæstìna,** Boiss. Lvs. 3–6 in. long: st. very short, 1–3-fld.: tube 2–3 in. long: fls. pale yellow, tinged with lilac; outer segms. oblong, upper one-fourth reflexed; claw auriculate; inner segms. minute, narrowly lanceolate. Mountains of Palestine.—Fls. in winter. Very near *I. caucasica,* but distinguished by its longer acuminate spathes and the color of the fls.

91. **Willmottiàna,** Foster. Lvs. about 8, with a white horny edge, broad, not acutely channelled, deep glistening green: st. 6–8 in. high, 4–6-fld.: fls. sessile, lavender or pale purple; tube 2 in. long; outer segms. oblong, with a white patch at the throat, marked with veins and patches of deeper purple, claw with white and purple markings; outer segms. small, depressed, cuspidate; style-crests small, triangular. Mountains of E. Turkestan. Gn. 59, p. 411; 75, p. 128; 66:8. G.C. 47:364; III. 29:271.—Resembles *I. caucasica* in habit and size but has narrower spathe-valves which are not inflated.

92. **caucàsica,** Hoffm. Lvs. about 6: st. very short, 1–4-fld.: fls. pale or bright yellow; outer segms. with an ovate blade and a very broad rhomboidal claw, with small auricles and a toothed or ciliated crest; inner segms. oblanceolate. Caucasus to Asia Minor, etc. Gt. 1874:800. C.L.A. 9:409.—Dwarfer habit than *I. orchioides.*

93. **Fosteriàna,** Aitch. & Baker. Lvs. 8–10 in. long: st. 6–8 in. long, 9–12 in. long after flowering, hidden by the clasping lvs., 1–2-fld.: outer segms. yellow, streaked with black, obovate-cuneate; claw not auriculate; inner segms. shorter, obovate, bright purple. March. Afghan and Russian boundary. B.M. 7215.—Very different from the allied species *I. orchioides* and *I. sindjarensis,* and so on, on account of the difference in color of the sepals and petals.

94. **cærùlea,** Fedtsch. (*I. caucàsica* var. *cærùlea,* Regel. *I. orchioìdes* var. *cærùlea,* Hort.). Lvs. about 8: st. about 15 in. high, bearing 3–4 fls. in the axils of the lvs.: fls. bright lilac; outer segms. with a ligulate claw expanded slightly at the base and an obovate-oblong blade with a conspicuous whitish crest and a yellow blotch on the throat; inner segms. pendent, with a narrow pointed lanceolate blade. Turkestan.

95. **warleyénsis,** Foster. Lvs. 6–7, 6 in. long, 1–1½ in. broad, with a conspicuous horny margin: st. 1 ft., 3–5-fld.: fls. sessile; outer segms. with a strap-shaped claw expanding into an orbicular blade, deep violet with a whitish crest and an orange patch at the throat, claw pale violet with deeper markings; inner segms. narrow, pale blue, purple, or violet, cuspidate. Turkestan. B.M. 7956. Gn. 61, p. 241; 72, p. 635. G.C. III. 31:386. J.H. III. 44:339. F.S.R. 3:344. G.M. 46:322.

96. **sindjarénsis,** Boiss. Lvs. about 8, crowded, distichous, glossy above, conspicuously striated below, 8–10 in. long, 1½–2 in. broad: st. 6–9 in. long, 3–6-fld.: fls. slaty lilac; outer segms. with an obovate, reflexed blade narrowed to a claw, with darker lilac lines and a small yellow crest; inner segms. oblong, clawed. Feb. Deserts of Mesopotamia. B.M. 7145. G.C. III. 7:365. J.H. III. 28:227; 48:97. Gn. 69, p. 134. Gn.W. 21:260; suppl. pl.—Plants ½ft. high. Var. **assyriaca,** Lynch (*I. assyrìaca,* Hort. or Haussk.), is a white variety from Mesopotamia. Gn. 69, p. 195. C.L.A. 9:409.

97. **fumòsa,** Boiss. & Haussk. Lvs. about 10: st. 6 in. long: outer segms. spatulate-oblanceolate, recurved above the middle, claw with a yellow crest; inner segms. minute, spatulate, toothed. The fls. are greenish yellow, shaded with smoky gray. Dry fields, Syria.—Perhaps a variety of *I. sindjarensis.*

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98. **orchioìdes,** Carr. (*I. caucásica*, Regel). Fig. 1977. Lvs. about 6: st. 12–15 in. long, with distinct internodes: spathes 1-fld., 2 in. long: fls. yellow; outer segms. with an obovate blade, and a purple blotch on each side of the crest of the claw; inner segms. oblanceolate, less than an inch long, and generally sharply deflexed, with a long filiform claw. B.M. 7111. Gn. 53, p. 482. R.H. 1880, p. 337. Spring. Var. **oculàta,** Maxim. Blade of the outer segms. more spotted.

SUBGENUS XIPHIUM.

A. *St. 1 ft. or more in length.*
B. *Tube very short or none.*
C. *Claw of the outer segms. pandurate* ..... 99. **Xiphium**
CC. *Claw of the outer segms. broadly cuneate* ..... 100. **xiphioides**
BB. *Tube usually more than ½in. long.*
C. *Outer bulb-coats thick and leathery.* 101. **juncea**
CC. *Outer bulb-coats thin membranous.*
D. *Outer segms. with a rudimentary beard* ..... 102. **Boissieri**
DD. *Outer segms. not bearded.*
E. *Inner segms. obovate-lanceolate, emarginate* ..... 103. **filifolia**
EE. *Inner segms. lanceolate, pointed* ..... 104. **tingitana**
AA. *St. very short or none.*
B. *Lvs. acutely quadrangular.*
C. *The lvs. very short at flowering time* ..... 105. **reticulata**
CC. *The lvs. long, much overlopping the fls.*
D. *Inner segms. oblanceolate.* .. 106. **Histrio**
DD. *Inner segms. linear-lanceolate....* 107. **Vartanii**
BB. *Lvs. cylindrical, 8-ribbed* ..... 108. **Bakeriana**
BBB. *Lvs. linear, channelled with thickened edges* ..... 109. **Kolpakowskiana**

99. **Xìphium,** Linn. (*I. hispánica*, Hort. *I. spectábilis*, Spach). SPANISH IRIS. Fig. 1978. Lvs. about 1 ft. long: st. 1–2 ft. high: pedicel long. tube obsolete; outer segms. 2–2½ in. long, violet-purple, yellow in the center; inner segms. as long, but narrower. Late June. Spain and N. Afr. B.M. 686. Gn. 20:442; 30, p. 385; 54, p. 471.—Long cult. and well known. Hardy in N. J. in protected situations. Var. **lusitánica,** Foster (*I. lusitánica*, Ker). Fls. yellow. B.M. 679. Var. **Bâttandieri,** Foster. Fls. pure white, except the orange keels of the outer segms. Lvs. very glaucous. Algeria.

100. **xiphioìdes,** Ehrh. (*I. ánglica*, Hort.). ENGLISH IRIS. Lvs. about 1 ft.: st. 1–2 ft.: fls. dark violet-purple in the typical form; outer segms. orbicular, yellow in the center; inner segms. shorter, oblong. French and Spanish Pyrenees. B.M. 687. R.H. 1891: 36; 1907, p. 446. Gn. 30, p. 384; 31:212; 54, p. 471. Gn.M. 15:362. G.W. 12:547 and p. 549 (vars.).

101. **júncea,** Poir. (*Xiphium júnceum*, Klatt). St. slender, erect, rigid, 9–18 in. high, bearing 1 (rarely 2) golden yellow fls., 2–3 in. diam.: lvs. rigid, slender, rush-like, 18–24 in. long: outer segms. with an orbicular blade shorter than the cuneate claw, recurved and veined with brown; inner segms. erect, oblanceolate. May, June. Algeria, Tunis, etc. B.M. 5890. Gn. 54:470.

102 **Boissièri,** Henriq. Lvs. linear, very deeply channelled, 1 ft. long: st. about a foot long, bearing few, reduced lanceolate lvs. and a single fl.: outer segms. 1½ in. long; blade obovate, reflexed, as long as the cuneate claw, bright lilac, with a yellow keel running down the claw, slightly bearded; inner segms. as long as the outer, erect, obovate, clawed, bright lilac. June. S. Portugal. B.M. 7097.

103. **filifòlia,** Boiss., not Bunge (*Xiphium filifòlium*, Klatt. *X. tingitànum*, Hook.). Slender and leafy, about 2 ft. high, bearing 1–2 bright violet-purple fls. 2–2½ in. diam.: lvs. about 1 ft., those of the non-flowering bulbs twice as long, weak, flexuous, convolute: outer segms. with a narrow claw expanding suddenly into a reflexed, suborbicular blade, bright yellow down the center; inner segms. erect, obovate-lanceolate, erose, notched. S. Spain and N. W. Afr. B.M. 5928; 5981.—Intro. 1869. Hardy.

104. **tingitàna,** Boiss. & Reut. (*I. Xiphium*, Desf.). St. stout, 1–2-headed, about 2 ft. high, hidden by the sheathing bases of the stout, falcate lvs., of which there are 6–7 on the st., the lower about 1 ft. long: fls. 2–3 in a cluster; outer segms. 3 in. long, with an obovate, reflexed blade, pale lilac, yellow in the center, and with a bright yellow keel down the claw; inner segms. shorter, oblanceolate, erect, incurved. Tangiers. B.M. 6775. Gn. 36:294; 63, p. 41; 71, p. 404; 74, p. 349; 75, p. 323. G.C. III. 37:339; 40:24; 48:16, 17. G.M. 40:377. J.H. III. 50:429.

105. **reticulàta,** Bieb. Lvs. 2–4 in a tuft, short, erect, quadrangular, with horny edges, elongating to 1½

1978. Iris Xiphium.—Type of bulbous iris. (×⅓)

ft.: st. very short: tube 3–6 in. long; fls. bright purple, very fragrant; outer segms. 2 in. long, yellow at the claw, with a low yellow crest; inner segms. narrower. Mid-April. Asia Minor and Persia. B.M. 5577. F.S. 5, pp. 509. R.H. 1890, p. 133; 1912, p. 454. Gt. 779; 13:452. Gn. 20:112; 54, p. 471; 59, p. 233. G.C. II. 11:501; 21:217; III. 52:339. F. 1860:161. G. 19:466. G.M. 51:695. F.W. 1871:225. Var. **histrioìdes,** Foster (*I. histrioìdes*, Dykes). Outer segms. much mottled with white and lilac on the claw and broad, orbicular blade. Asia Minor, Persia, and the Caucasus. Gn. 42:364; 62, p. 42 and 77, p. 42. G.M. 51, p. 87. J.H. III. 34:111.—Early-flowering, and fine for pots. Var. **Krèlagei,** Regel. Fls. red-purple, varying

greatly in shade; claw conspicuously veined. The common wild form of the Caucasus. Nearly odorless. L.B.C. 19:1829. Gt. 22:779. R.B. 18:60. G.C. II. 21:217. Var. **cærùlea**, Hort. Azure-blue. Var. **cyànea**, Regel. Blue. Gt. 23:797. Var. **màjor**, Hort. Like the type, but larger. Gn. 60, p. 198.

106. **Hístrio**, Reichb. f. (*Xíphium Hístrio*, Hook. f. *I. reticulàta* var. *Histrio*, Foster). Plants tufted, slender and flaccid: lvs. quadrate, with horny edges, deeply grooved on each face, 1 ft. long: st. very short, very slender, 1-fld.: fls. 3 in. diam.; tube 3–4 in. long, blue above; outer segms. obovate-spatulate, spreading, deep blue, with a yellow line in the center bordered with white and spotted and shaded with blue; inner segms. erect, oblanceolate, blue. Feb. Mountains of Palestine. B.M. 6033. Gn. 9, p. 29; 33:558. G.C. III. 12:729; 21:105; 45:55.—Related to *I. reticulata*, differing only in its paler, odorless fls., which are produced several weeks earlier.

107. **Vártanii**, Foster. Lvs. usually 2, 8–9 in. long, slender, finally longer: st. very short, hidden: tube 2½ in. long; outer segms. with a narrow claw, suddenly enlarged into an ovate-lanceolate blade, pale, slaty lilac, with darker veins and a crisp yellow crest down the claw; inner segms. erect, almost linear-lanceolate, pale lilac. Dec. Palestine, near Nazareth. B.M. 6942. Gn. 77, p. 69.—Not scented.

108. **Bakerièna**, Foster. Lvs. 3–4, 6–9 in. long, finally a foot or more after flowering, hollow, cylindrical, 8-ribbed: fls. single, on a short peduncle, fragrant; tube 3–6 in.; outer segms. with a long, obovate-elliptical claw, and a small, ovate, reflexed blade, intense violet, creamy in the center, with a yellow streak down the claw; inner segms. shorter, erect, oblanceolate, lilac; style-crests large. Feb., March. Armenia. B.M. 7084. Gn. 37:462. G.C. III. 7:293; 21: 103; 45:53. J.H. III. 34:177; 42:142. G.M. 40:118.

109. **Kolpakowskiàna**, Regel (*Xíphium Kolpakowskiànum*, Baker). Lvs. 5–6, wrapped round by a sheath at the base, very short at the flowering time, but growing longer, linear, channelled, with thickened edges: scape very short, 1-fld.; tube 2–3 in. long; outer segms. with a long, erect claw and an ovate, acute blade, deep violet-purple with a yellow keel down the claw; inner segms. oblanceolate, erect, pale lilac. Mountains of Turkestan. B.M. 6489. Gn. 17, p. 75; 33:558. Gt. 1878:939.—Very near *I. reticulata*, fls. at the same time, and is sweet-scented.

SUBGENUS GYNANDRIRIS.

110. **Sisyrínchium**, Linn. (*Morèa Sisyrínchium*, Ker. *Xíphium Sisyrínchium*, Baker. *I. maricoìdes*, Regel). St. 6–12 in. high, stout or flexuous, 1–3-headed: lvs. 2, slender, as long as the st.: fls. fugitive, lilac-purple, with a yellow, oblong spot on the outer segms. which are oblong-spatulate; inner segms. narrow-lanceolate, erect, pale; style-crests large, lance-deltoid. Widely spread through S. Eu., Afr. and Asia. B.M. 1407 (not good), and 6096.—Easily killed by frost. In *I. maricoides*, Regel, the filaments are said to be distinct from each other and from the style.

Of some of the names, found in catalogues, no complete description is available: *I. àmas*, Hort. Germanica group.—*I. angustìna*. Deep yellow, marked with maroon. Garden form of I. variegata.—*I. angustissima*, Hort. Fls. dark purple.—*I. brachysíphon*. Pale blue. Rhizomatous.—*I. británnica*. Pale pink, with the outer segms. veined with purple. Garden form of I. squalens.—*I. Brooksiàna*, Hort. Mauve-purple.—*I. candiàna*. Outer segms. reddish purple; inner segms. light lavender. Germanica.—*I. coreàna*. Like I. sibirica, early and a free bloomer.—*I. edìna*. Light purple and violet. Var. of I. neglecta.—*I. Fisheri*. Apogon.—*I. Gladstoniàna*. Hybrid of I. atropurpurea. Pale black, with yellow markings. —*I. grácilis*, Lichten.=Morœa tenuis. See also index, p. 1668.—*I. Guldìi*, Hort.—*I. ignitìtia*, probably Ignacite, a form of I. neglecta. Lilac, with the outer segms. shaded purple.—*I. ligulàris*. Purple. Germanica. — *I. macrántha*, Hort. Germanica. — *I. nígricans*. Lvs. short ensiform: fls. dull black to deep black. Distinct from I. atropurpurea by its uniform dark color and dwarf foliage. Oncocyclus.—*I. páncrea*, probably pancrace, var. of I. variegata. Buff and purple.—*I. Robinsoniàna*, F. Muell.=Morœa Robinsoniana.—*I. Rùdinii*, Hort., Herb. Fls. black-brown and claret. Said to be stronger and more free-flowering than the other oncocyclus irises.—*I. tuberòsa*, Linn.=Hermodactylus tuberosus. —*I. Vogelìana*. Similar to I. persica and I. Rosenbachiana, but earlier-flowering. Fls. variable in color, silver-gray predominating, with violet, rose or lilac markings. Var. *grandiflòra*. Large-flowering.

The following are garden hybrids, sometimes cult.: *I. interrígna* =I. germanica × I. pumila. Several color vars., pale yellow, citron, lavender, and claret-red: fl.-sts. 18 in. high, holding the fls. well above the lvs. —*I. mónspur*, Foster=I. Monnieri × I. spuria. Said to be very ornamental.—*I. ochro-aùrea* or *ochaùrea*, Foster=I. orientalis × I. aurea. Outer segms. rich yellow with a cream-colored border; inner segms. erect, yellowish, bilobed at the apex. 5 ft. —*I. páravar* or *I. párvar*, Foster=I. paradoxa × I. variegata. Sts. 2-fld.: fls. dark purple with the bases of the segms. pale brown with darker markings. G.C. III. 29:398.—*I. síndpers*, Van Tubergen=I. sindjarensis × I. persica. Intermediate between the parents in foliage and general habit. Free-flowering: fls. blue like those of I. sindjarensis but lacking the conspicuous patch at the apex of the outer segms.

The following species are sometimes cult: *I. gracilipes*, Gray. Rootstock slender, wide-creeping: lvs. finally 1 ft. long, ⅛in. broad: st. 8–10 in. high, forked once or twice: spathes of a single, membranous, scarious valve which reaches about the top of the tube, 1-fld.: fls. purple or lilac; outer segms. obovate-cuneate, deeply emarginate, about 1 in. long, white in the middle, veined with purple and bearing a yellow crest; inner segms. oblanceolate emarginate, smaller, uniformly colored. Japan. B.M. 7926.—A small pretty iris of the Evansia group.—*I. Pùrdyi*, Eastwood. Rootstock thin and wiry: lvs. 1 ft. long and ⅛–⅛in. wide, thick, sub-erect: st. 4–6 in. long, entirely covered by the short inflated bracts: spathe-valves 1½–2 in. long, inflated, the outer slightly keeled: fls. pale straw-yellow; tube 1¼–1½ in. long; outer segms. broadly lanceolate, veined with brownish purple; inner segms. lanceolate, spreading, faintly veined. Gt. 35: 1222 (as I. Douglasiana). —An iris of the apogon group closely related to I. bracteata from which it differs by the long linear perianth-tube.—*I. ténuis*, Wats. Rootstock slender, wide-creeping: lvs. thin, ensiform, 1 ft. long, ⅛in. broad: st. equaling the lvs., branched: spathe-valves scarious, 1 in. long, 1-fld.: outer segms. oblong-spatulate, white, yellow at the throat and marked with purple veins; inner segms. smaller, erect, emarginate. Ore. G.F. 1:6. Apogon.—Rare, found only in Ore., and not in cult. except possibly in collections.

Two Chinese species recently offered in England are *I. Bulleyàna*, Dykes. Foliage grass-like: fls. described as of pretty form though not striking, deep blue; standards blue-purple and falls mottled with same color on creamy ground.—*I. Fórrestii*, Dykes. Lvs. grassy, linear, 12 in., glaucous beneath: sts. numerous, about 12 in.: spathes green, with 1 or 2 fls.: falls with veins of dark red or purple-brown; blade drooping, pale lemon-yellow, sometimes with purplish veins. G.C. III. 47:418.

HEINRICH HASSELBRING.

IRONWOOD: Usually *Ostrya virginica;* in S. Calif., *Lyonothamnus floribundus*; in Ariz. *Olneya Tesota*; in Texas, *Bumelia lycioides*. Many hardwooded plants bear this name.

IRRIGATION. Irrigation in its broadest sense includes all problems of collecting, storing, delivering, and applying water to the land through the construction of dams, reservoirs, canals and laterals, and the application of power when necessary to deliver the water; while in a restricted horticultural sense it is a method of cultivation, having for its object to increase and regulate the water-supply in the soil.

In this latter sense, irrigation is a necessary practice in the arid regions, and is advisable in the humid regions in proportion to the intensity of the cultivation and the value of the crop grown. Thus in Florida, with an average of 60 to 70 inches of annual rainfall—usually well distributed—irrigation has been largely introduced in the past few years for horticultural crops and even for tobacco, as an insurance against loss or damage by the occasional droughts. The first cost of a small irrigation plant in Florida, for 20 acres or over, is said to be approximately $100 to $150 an acre; the interest on which, and the necessary repairs, would amount to $5 to $10 an acre each year. This is a small expenditure to insure a crop against loss or injury where the value to the acre is so great as in many horticultural lines. Irrigation is needed not only to prevent the actual death of the plants, but to promote a uniform, rapid, and continuous growth, which is necessary for the development of the finest texture or flavor of the commercial crop.

King has shown that the value of a crop saved in Wisconsin, such as the strawberry, in a season when the crops generally are injured by drought, may pay all the expenses of the original cost of the irrigation plant.

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In the semi-arid regions west of the 100th meridian, with a rainfall of 20 inches or less, crops are liable to be entire failures three or four years out of five; while with an irrigation plant there should not be a failure one year in five. In the arid regions with less than 15 inches of rain, irrigation is a necessity on most soils. Here the work has been highly organized and systematized, so that the cost of water delivered at the field amounts to $2 to $5 an acre each year. Under skilful management, the most abundant yields are secured. The most careful management is required in the application of water to prevent serious injury to the land and to avoid actual injury to the crop in rendering the plants tender and liable to disease, and in maintaining the quality and flavor, both of which are liable to depreciate unless good judgment is displayed in supplying water.

Sources of water-supply.

The principal sources of water-supply are streams, surface wells, artesian wells, and the storage of storm waters. For small irrigated tracts near cities, the city water-supply may often be used to advantage. In other localities the nature of the conditions will determine the most economical source from which to secure the water. Perpetually flowing streams, if situated in such a way that water can be carried to the land by gravity, have the advantage of cheapness of construction and maintenance. On the other hand, if the stream supplies others in the community, there is liable to be trouble and expense in establishing and maintaining water-right claims and in securing water when needed for the crop. Questions arising out of the water-rights on streams and rivers in the western states, with the various state laws, the multiplicity of court decisions on the most intricate legal questions—both in different states and different countries along the line of the stream—the absence in most states of adequate police or judicial powers vested in the irrigation commissioner, have led to the most perplexing and bewildering state of affairs, and have involved the states and individuals in enormous costs for lawsuits, resulting in many cases in the apportionment of many times the volume of the stream to the settlers along its bank.

The large planter must seek some perennial and abundant supply of water, as is furnished by streams, but it is safe to say that all streams of any size in the western part of the United States are already appropriated to their fullest extent, although the water so appropriated is not all in present use. Smaller planters are much more independent with some of the other sources of supply mentioned above. Wells from 10 to 20 feet deep, with pumps operated by windmills, or wells of a maximum depth of 50 feet operated by many forms of gasolene, hot-air or portable engines, attached to direct-acting pumps or centrifugal pumps, form in general a very satisfactory means of irrigating small areas.

Over limited areas artesian wells have been very successfully used. If they are flowing wells delivering a considerable stream, they can be used over small areas without storage reservoirs, or over much larger areas with reservoirs. They should be capped in all cases, where possible, so that the flow can be stopped when not actually needed.

In many places it is possible, at a comparatively small expense, to construct a dam to collect the storm waters. The magnitude and expense of such work will depend entirely on the configuration of the surface, the area of the watershed, the volume of the water to be handled as well as the nature of the soil, and the material out of which the dam is to be constructed.

Methods of raising water.

Various methods are used for raising water from streams, wells, or storage reservoirs which may lie below the general level of the land to be irrigated. Hydraulic rams are sometimes used for small areas, but these are not economical when a small volume of water is at hand, as only about one-seventh of the water can be collected. Open buckets carried on an endless belt, operated by either windmills, or steam-power or even horse-power, are used with success and offer the advantage of cheap construction. The ordinary cylinder or plunger pumps are usually employed when the water has little or no sediment, and are operated by windmills or by steam or other form of engine. When the water carries considerable sediment such pumps are liable to wear away rapidly, and the centrifugal pump is the most economical form to use. The relative first cost of equipment for pumping with windmills or with gasolene or hot-air engines of approximately equal horse-power is about the same. The windmill, however, is dependent upon a mean velocity of wind of about 8 miles an hour, while the engine may be operated at any time, and is thus more reliable when either form of motive power is taxed to nearly the extreme limit. There are many kinds of windmills on the market, and many forms of home-made construction are in use.

Storing and conducting water.

Storage reservoirs for streams and for storm waters vary in size and in cost as well as in mode of construction according to the character of the land, size of area, volume of water, nature of the material of construction, and demand for the water. The construction of such reservoirs sometimes involves engineering problems of the most difficult kind, demanding the expenditure of immense sums of money.

In the use of windmills, it is necessary to have small distributing ponds or tanks, as the direct flow from the pump is usually so small and varies so much with the velocity of the wind that it cannot be depended on to water any considerable area. Where it is stored it can be turned out on the land in large volumes, so that it spreads over the surface and waters the whole area uniformly. For an ordinary windmill the ponds are from 50 to 100 feet square. They can be stocked with fish and thus be a source of some revenue and variety in the family supplies. Unless the pond is situated on a slight elevation, the earth for the embankment must be taken from the outside. The banks are usually made with a slope of 1½ to 1 foot. For a bank 5 feet high and 2 feet across the top, the side would be about 7½ feet and the base about 13 feet wide. If the ground is at all pervious to water, the bottom of the pond should be protected from undue seepage and loss of water by puddling. This should be done with clay, if this is obtainable. This puddling is often done by driving horses or cattle in the pond while the surface is wet. A pond of the size indicated above, operated by a windmill where the mean wind velocity is about 8 miles an hour, will irrigate from 3 to 5 acres of land in the semi-arid regions. Such a pond could be counted upon to irrigate from 5 to 10 acres where, as in the East, only one or two irrigations would be required during the season. The size of the reservoirs and the area they will irrigate, when supplied by steam or other kind of engine, will depend upon the available water-supply and upon the size of pump and power used.

Ditches and flumes.

The water is usually carried from the stream or storage reservoir by gravity in open ditches. This involves loss by evaporation from the surface and by seepage through the soil. When the water-supply is limited and its value is consequently great, terra-cotta pipes, iron pipes, cement or wooden pipes may be used. When the surface of the country is uneven and ravines have to be crossed, flumes are used to carry the water on an even grade across the depression. These flumes may be iron pipes, open wooden troughs,

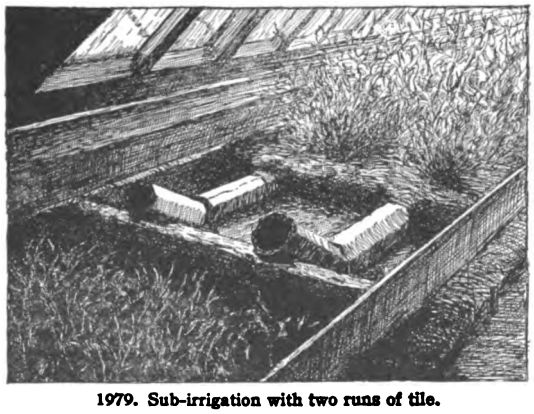
or wooden pipes held together with substantial hoops. If the depression is not too great the ditch may be built up on an earth embankment. When the water has to pass through a gravelly soil, or when for other reasons the soil is very pervious, special precautions should be taken to prevent seepage by using pipes, cementing the sides of the open ditch, or puddling the ditch with clay or similar material.

Application of water.

The water is usually applied to the ground by flooding over the whole surface. For this purpose the surface must be perfectly level and the ground carefully prepared, so that the water will flow uniformly and quickly over the entire area and be of uniform depth throughout. When crops are cultivated in rows or on beds, the water is allowed to flow down in the troughs between the rows, and there must be a sufficient head of water to reach the ends of the rows in a reasonably short time, so that the whole width of the field will be properly watered.

Where the surface of the ground is so uneven that surface flooding cannot be used, basins are formed by throwing up slight ridges, with a plow or other implement, and the water turned into these basins in succession and allowed to accumulate to a sufficient extent. This method is particularly applicable to fruit trees, although it is occasionally used in other crops. In very sandy soils the water is occasionally carried through the field in wooden troughs, which admit of sufficient seepage to water the land. This prevents the undue seepage which might occur in such soils if the water was flowed over the surface. Another method is to distribute the water through the field in iron pipes, with openings at frequent intervals, in which nozzles can be attached to deliver a fine spray over a small area. With four or five such nozzles an attendant can water a considerable area of ground in the course of a day. Such an irrigating outfit in Florida was supplied with a power equivalent to about one horse-power an acre. The mains and laterals were of 1-inch or 1½-inch iron pipes laid near the surface of the ground, the laterals about 100 feet apart, with hydrants every 50 feet. Tanks were originally used, but it was found desirable to pump directly into the mains to insure a sufficient pressure.

Care should be exercised in applying water to the land. Where water is plentiful there is a common prac-



1979. Sub-irrigation with two runs of tile.

tice of using such an excess as to injure the flavor of fruit, increase the liability of disease, and eventually injure the land by the accumulation of seepage waters and of alkali. As a rule, there has been very much more damage from over-irrigation than from the use of too little water. The first two or three years a soil usually requires a considerable amount of water, but after becoming well moistened to a considerable depth it should require comparatively little water thereafter to maintain its fertility. As it is not easy to apply just the proper amount, the excess should be provided for. If there is any reason to fear lack of drainage, the land should be thoroughly underdrained before irrigation is started, or at any subsequent time when the need of it becomes apparent.

Irrigation always should be supplemented by the most thorough cultivation. After going to the expense of watering the soil in this way, it is poor economy to allow the water to escape by evaporation or otherwise; therefore every precaution should be used in thorough, subsequent cultivation and in the exclusion of weeds, to conserve the moisture so applied. The intelligent horticulturist will find that in the use of this expensive method of maintaining a proper water-supply in the soil, it is incumbent upon him, even more than if the method were not used, to give careful attention to all the ordinary methods of preparation and cultivation in order to maintain the advantages he has established by the irrigation plant.

MILTON WHITNEY

Sub-irrigation in the greenhouse.

The term sub-irrigation is used to describe a method of supplying water to the roots of plants by means of some form of conduit placed below the surface of the soil. In greenhouse operations, the essential features of the plan are a level water-tight bench-bottom, and tile, or pipes, to serve as conduits for the water. The tile, or pipes, are laid directly on the bench-bottom, and over these the soil is spread, usually to the depth of about 6 inches. When water is introduced in sufficient quantities through the tile or pipes, it passes out at the joints, or perforations into the soil.

When applied to greenhouse operations, the term sub-watering has been proposed by E. S. Goff, for the reason that irrigation is used to denote watering on a large scale out-of-doors. It may be said, however, that the words watering and irrigation do not indicate the scale of operations with any degree of accuracy; therefore it seems as well to use an old word as to coin one, especially when the familiar word expresses the meaning intended.

Experiments in watering plants by this method were begun in the winter of 1890 and 1891, at the Ohio Experiment Station. The suggestion came from the result obtained in an effort to check the lettuce rot. Water was introduced to the soil in boxes by means of a pipe, in a manner similar to the method often employed in watering hills of melons and cucumbers. When the plants were watered in this manner, the lettuce showed so much more vigor than that watered in the ordinary way, that operations were begun at once on a larger scale; first in a bed on the ground having a clay bottom, then on a water-tight bench, made of lumber, and finally, on tile benches, covered with cement.

In all of the earlier experiments the water was introduced through pipes, or drain-tile, laid about 2 feet apart on the bottom of the benches. Goff has used brick instead of tile, placing them near enough together to touch. They were set on edge in a galvanized iron pan, made for the purpose. J. C. Arthur clipped off the corners of the bricks, so as to facilitate the flow of water. The Ohio Station has modified this plan by using common drain-tile, laid so as to touch, thus covering the entire bench bottom, instead of lines of tile every 2 feet, as at first.

Benches made of lumber have proved unsatisfactory because of the swelling and warping of the boards. Solid beds on the ground have not been successful, except where an impervious clay bottom existed. Galvanized iron adds greatly to the cost of construction, and lasts only a short time. The only suitable bench for greenhouse sub-irrigation is one made of materials which are not acted upon by water.

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A well-made tile-and-cement bench seems to be the only form of construction that will meet the requirements. Such a bench does not cost so much as to preclude its use, and will last as long as any other part of the greenhouse. In describing such a bench, it will not be necessary to enter into details, except such as relate to the method of watering under discussion. The bench must be water-tight, and this essential condition is secured by spreading a layer of cement, an inch or more in thickness, over the tile bottom. It is not a matter of any moment whether flat tile or common drain-tile are used, except in the quantity of cement required. The cement must be spread with care, so as to secure a perfectly flat level bottom, otherwise the water will not flow uniformly in all directions. The sides of the benches are made of cement also, but need be only 2 or 3 inches high, or of sufficient height merely to retain the water. Boards or slate are placed outside the cement wall to retain the soil. The tile-bottom may rest on iron or wood cross-pieces. Wood has been in use for this purpose at the Ohio Station for twenty years and shows no signs of decay, because it is out of reach of the water.

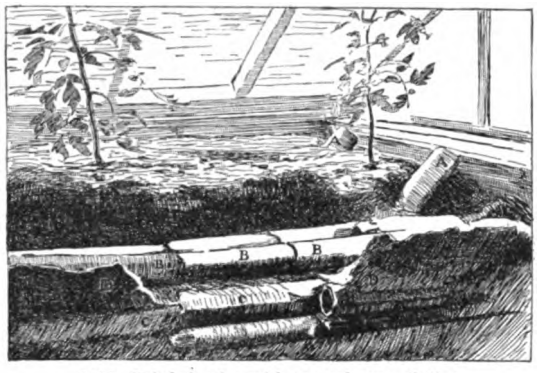
Twenty years' experience shows that a perfectly constructed bench-bottom, with the tile laid 2 feet apart, will serve satisfactorily in distributing the water to all parts of the bed, provided the tile are straight, so as not to impede the flow of water. The tile are laid in the same manner as tile-drains, and lengthwise or crosswise the bed, as preferred. Better results are usually secured if they are laid crosswise than lengthwise, as it is difficult to secure an even flow from long lines of tile. A little cement or mortar is used at each joint simply to hold the tile in place when the soil is put in the bench, but not enough to impede the flow of water from the joints. The first tile where the water is introduced is laid at an angle, one end resting on the edge of the bench side. This leaves a wide opening at the first joint, which is closed with cement. A better plan is to use a curved sewer-pipe for the inlet, but this is not always available. The picture (Fig. 1979) shows how the tile is laid on the bench bottom, being a view of a side bench in a carnation-house.

Following Goff's suggestion in the use of brick, tiles have been used over the entire bench-bottom with good results, and it seems probable that this will be found to be the best form of construction, as it appears more certainly to insure an even distribution of water. The method of construction is the same as above described, for the two plans differ only in the number of tiles employed to distribute the water. When the bench-bottom is covered with tile, placed near enough together so that the soil will not fall between, it will readily be seen that water introduced at any point will flow to all parts of the bed in and around the tile. It needs simply to be brought up to such a level that it will reach the soil, when capillary attraction will complete the distribution. Fig. 1980 shows a bench in a tomato house constructed after this plan. *AA* are the inlets; *B* the irrigating tile, from which the soil has been removed; *C* is the tile bench-bottom, covered with cement. The same size of tile, viz., 2½- or 3-inch, is used both above and below. *D* is the cement side, which has been broken away to show the method of construction. The outer board has been removed also.

The cost of construction need not be discussed here, except to state that the only items extra, more than are required in any well-constructed greenhouse, are the cement bottom and the tile in which the water is distributed.

A plan has been devised for applying water to small plants in flats which may properly be mentioned under this head. The flats are shallow boxes with slatted bottoms. When the plants require water, the flats are placed in a shallow vat of water and allowed to remain until the surface of the soil appears to be damp, or even wet.

A watering in this manner is far more efficient than by the ordinary method. Taken in connection with sub-irrigation in the benches, a crop of lettuce can be brought to marketable size nearly two weeks earlier than when surface-watering is practised. Anything like a full discussion of results of experiments in watering plants in the greenhouse by sub-irrigation would be too voluminous for an article in this connection. A brief review of the results obtained at some of the stations,



1980. Sub-irrigation with several rows of tiles.

together with a short discussion of some general principles, will serve the purpose intended. The increase in weight of lettuce from sub-irrigated plats over those watered in the ordinary manner has been reported by Rane, as 25 per cent and by Goff and Cranefield as 26 per cent. At the Ohio Station the range has been from 25 to 100 per cent. In the latter case the result was obtained by commencing with the plants as soon as taken from the seed-bed, and carrying the two lots through to the termination of the experiment, one by watering altogether on the surface of the soil, the other by subirrigation. Each of the experimenters speaks of a gain in earliness of several days, by sub-irrigation. Rane secured similar results with long-rooted radishes by this method of watering, but not with the turnip-rooted sorts, while Munson doubled the crop by watering below. Better results have usually been secured at the Ohio Station with the turnip-rooted than with the long varieties, but in all cases there has been a gain in favor of sub-irrigation, varying from 50 to 100 per cent. Rane found that sub-irrigation increased the yield of tomatoes, but the gain was not large. Essentially the same results have been secured in Ohio. The tomato crop has not been greatly influenced by the manner in which the water was applied, and the same is true of beets, while sub-irrigated cucumbers and parsley have shown a decided gain over surface-watered. Carnations, roses, chrysanthemums, sweet peas, violets and smilax have been under experiment by the two methods of watering, and while no such marked results have been secured as with lettuce and radishes, the sub-irrigated plats have shown superiority over those watered in the ordinary manner, in nearly all cases. With carnations the improvement has been mainly in length and stiffness of stem.

Aside from the increase of crop secured by sub-irrigation, there are other considerations which may be urged in its favor, and these are embodied in the following general propositions:

1. *Watering by sub-irrigation in the greenhouse saves labor.* The amount of labor saved depends mostly upon the completeness of the arrangements for watering, but there is a saving in the number of applications as well. It is possible to reduce the time employed in watering a house, or series of houses, to one-fifth the time usually required.

2. *Watering by sub-irrigation assures an abundant and uniform supply of water to all parts of the bed.* Perfect construction of the benches is assumed in this case, but with such construction watering becomes almost automatic, the only care necessary being to look after such portions of the beds as may, by position, be subject to unusual conditions of air or sunlight.

3. *Where sub-irrigation is practised in the greenhouse, the surface of the soil does not become compacted, but retains its original loose, friable condition.* It is true that where frequent syringing is practised the surface of the soil becomes more or less hardened, but not to the extent that occurs in surface-watering, and the condition is easily remedied, whereas in the other case it is not. It follows that a heavier soil may be used for sub-irrigation than with surface-watering.

Still other considerations might be urged in favor of this method of watering, but many of them would apply to special cases only. Regarding the effect of the method upon insects and diseases, but little can be said. Lettuce rot is less prevalent upon sub-irrigated plats than upon those which are surface-watered, but in extreme cases plants succumb to the disease, whichever method of watering is practised. Munson found that radishes suffered more from the attacks of millipedes upon sub-irrigated plats than upon plats watered in the usual manner. Nematodes work upon the roots of roses, whichever way the plants are watered. The manner of watering has no apparent effect upon the red-spider. Even in houses watered wholly by sub-irrigation this pest is no worse than in houses where the water is applied to the surface of the soil. It may be said, however, that nearly all classes of plants are more easily kept in a healthy growing condition, and are thus better able to resist enemies of all sorts, when sub-irrigated than when supplied with water in the ordinary way.

This method of applying water to plants in greenhouse benches has now been sufficiently tested to determine its value. All that now remains is to devise ways and means to utilize what is known concerning it. The adaptation to suit particular cases must be made by individuals, but this will be far easier in the future than in the past, because better methods of construction prevail than formerly. The success of sub-irrigation in the greenhouse is now simply a question of mechanics.

W. J. GREEN.

Irrigation for vegetable-growers and other gardeners.

In this Cyclopedia, it is not the purpose to discuss the general agricultural practice of irrigation but rather those phases that apply particularly to gardening operations. In arid countries, the garden irrigation practice will naturally follow the general methods of the region. In humid countries or regions, the practices may be very special. In the growing of strawberries and garden vegetables in the eastern United States, special irrigation practices are developing, and these may be briefly considered.

Success in crop-growing depends on many factors. If one of these factors is deficient to such an extent as to limit the crop in yield or quality, no excess of the other factors will suffice to make up the lack. Thus, if nitrogen is present in the soil in only very minute quantities, no amount of phosphorus or potash will enable the plant to offer the husbandman a worthy harvest. In vegetable-gardening the amounts expended in making the various conditions favorable are relatively large. Accordingly, if one factor is deficient, the loss is very heavy. Perhaps the moisture factor is more often to be charged with the responsibility for poor returns than any other single deficiency.

We are told that 10 inches of rainfall in a year is sufficient for the production of successful crops under the methods of dry-farming. We are told that 20 inches of precipitation is sufficient for the production of successful crops under ordinary farm methods—provided it is well distributed throughout the year. Most places in the eastern states enjoy from 30 to 40 inches of rainfall a year. Nevertheless, there is hardly a season in which crops, and especially vegetable crops, do not suffer for lack of moisture during at least a month. The solution of this seeming paradox lies in the fact that our rainfall is poorly distributed through the growing season. We may have as much as 9 inches in a single month, and occasionally less than 1 inch. The total for three months in succession may be as low as 4 inches. Even such a condition as this does not frequently appear upon the weather records; for a period of drought may be followed by torrential rains sufficient to make up the average rainfall after the harm is done.

In view of these conditions, it is necessary that the vegetable-grower take measures to prevent the loss, through lack of sufficient moisture, of all the time and money that he has invested in land, tillage, fertilizer, seed, planting, cultivation, and care, to say nothing of the loss of the profit which he may reasonably expect. He may accomplish much by so managing his land as to conserve to the utmost the rainfall that is his. He may leave his land rough over winter to prevent run-off, he may harrow frequently till planting time, he may maintain an effective mulch throughout the season; even so through lack of rainfall—through absence of moisture to be conserved—he may lose his whole crop or so much of it that he might better have left the ground unplanted.

Within the past ten years, the possibilities of irrigation have become apparent to many vegetable-producers. They have found that the elimination of the moisture factor as one of the obstacles to successful crop-production has made possible larger yields, better quality and early maturity, with all the advantages in economy of management and in returns that accompany these gains. Irrigation has proved of especial value when sowings are made in midsummer for autumn maturity, at transplanting time, and as crops approach harvest.

Surface irrigation is practised to a very limited extent in the East. The method consists in conducting water along the end of the plat to be irrigated and allowing it to flow into furrows between the rows of the crop. It is best to permit the water to reach the far end of the row as soon as possible and then allow it to be absorbed evenly throughout the length. If this is not done, the part of the field next the supply-ditch will receive much more water than the remainder. This form of irrigation is useful on level land where there is abundance of water and where the soil is suitable. Light soils drink up the moisture so rapidly that an even distribution of the water is difficult and uniform results may not be secured.

Boston gardeners employ hose in watering their plantations. A system of underground pipes is installed in such a way that 50 feet of hose will reach all parts of the block. The cost of installation for the first acre is reported in a Massachusetts bulletin as being about $65 and successive acres may be piped for approximately $50. An acre may be given 1 inch of water by one man, using 1¼-inch hose, in five or six hours. Hose irrigation is objectionable on account of the disturbance of plants, the danger of injury to the physical condition of the soil, the amount of labor, and the frequent replacement of hose.

Sub-irrigation is practised in certain districts of Florida and on some muck land areas in the North. In the Sanford, Florida, district, which is typical, the water-supply is from artesian wells. The land is underlaid with tile which is accessible at both its highest and its lowest points. Thus it serves for both watering and drainage. The impervious bottom which underlies the soil is essential for the successful operation of

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the plan. On the muck lands of the North, the object is accomplished by closing the drainage outlets and so raising the water-table that the surface soil is moistened. It is not good practice to keep the water-table high, because it inhibits the proper root-development of the plants.

Growers of vegetables in the eastern half of the United States are using various types of overhead irrigation far more than other methods. These systems usually involve the establishment of lines of pipe mounted on posts and carrying either sprinklers or small nozzles. These lines are so spaced that the ground may be evenly covered by the spray. Some types of sprinklers are so constructed as to revolve and cover an area of perhaps 25 feet radius. These are objectionable because they cannot cover the ground as evenly as other types.

More commonly employed are small nozzles which consist merely of a threaded plug of brass through which a straight hole is accurately drilled. These are set in holes in the pipe-line. Recently various modifications and improvements in these nozzles have been made. The nozzle line is screwed together and mounted on the posts, and a special machine equipped with a small level is used for tapping and threading the holes. The nozzle line is mounted with a union in which is set a handle for turning to cast water far to each side or to cover the near gound by throwing vertically. The nozzles are usually spaced about 3 feet apart and throw a fine solid stream which breaks at some distance from the opening. When the water reaches the ground, it is a fine mist similar to a light rain. Twenty-five to forty pounds of pressure is sufficient to cover a belt ranging from 20 to 30 feet on either side of the line.

A long line, of say 300 feet, would consist of 100 feet of 1¼-inch pipe, 100 feet of 1-inch pipe, and 100 feet of ¾-inch pipe.

Nozzle lines are supported in many different ways. The consensus of opinion at present is that they should be about 7 feet above the ground to avoid interference with work that is being done. These posts must be set 15 feet apart to carry ¾-inch pipe and a little farther apart for larger sizes. Posts of pipe or wood are most commonly used, but suspension from a cable supported by posts 100 feet or so apart is gaining in favor with vegetable-gardeners.

Occasionally, for temporary purposes, as for a single watering of young strawberry plants, the pipes are simply laid on the ground and turned by the handles in the usual way. Other growers have small horses which may be placed on the ground to carry the line temporarily. Mechanism has been devised by which a large number of lines may be automatically controlled from a single point, turning the spray constantly from one side to the other.

The main at the end of a field may be buried and the lines supplied through risers, or it may be carried on the first post of each of the rows which support the nozzle lines.

Comparatively few gardens are so located that a suitable supply of water is not available at reasonable cost. There are several possible sources. Some gardeners pump directly from streams or ponds, ordinarily using a gasolene engine and the triplex type of pump. In other sections, where the water-table is relatively near the surface, and where the ground-water is abundant, wells are sunk. Some employ a number of driven wells and gather water simultaneously from all of them. At Rochester, New York, many wells of large diameter with concrete walls are to be found. The method of sinking them is ingenious. A circular ditch of the desired diameter, say 15 to 25 feet, and about 2 feet wide and 4 feet deep is dug. In this is built by means of wooden forms a concrete ring. The lower edge of this ring is beveled outward at an angle of perhaps 30°. The ring is strongly reinforced and short bits of pipe are inserted radially. After the concrete in this ring has set and the forms have been removed, the work of digging is begun within. The earth is removed, one man seeing that it is taken evenly from the sides of the well under the sharpened edge. As the work progresses the ring sinks into the ground and radial concrete blocks are built upon it to serve as a wall. The well may be sunk to a depth of 20 or even 25 feet. The large diameter offers great gathering surface, and an abundance of water may be secured from a stratum that would not yield a sufficient amount by means of small wells.

Many gardeners in the neighborhood of cities are able to utilize the municipal water-supply, taking advantage of the low rates which are granted to large users. Some are able to procure water at a cost as low as 6 cents a thousand gallons. This is about as cheap as pumping.

Many questions arise as to the handling of irrigation-water. The practices have not been worked out nearly so fully in the East as in the West. Almost no well-planned experimental work has been conducted, and opinions among users vary greatly. Although a few prefer to apply water in small amounts and frequently, most seem to think that thorough irrigation is preferable. Most men water at night or when it is cloudy, but some do not hesitate to apply even in midday, thinking that the plants are benefited by the cooling. It is well so to plan the work that the ground will not be muddy at harvesting-time. With tomatoes, precautions must be taken against cracking. This is usually occasioned by heavy watering after the plants have been kept quite dry. Lettuce requires special care to avoid the development of rots of various sorts.

The use of irrigation-water does not relieve the grower of the necessity for good drainage or careful conservation of moisture. The former guards against overwatering or heavy rains which may come just after a thorough irrigation. The latter saves water, which is costly and keeps the soil in better physical condition.

Overhead irrigation systems are used to some extent for spraying, for the application of fertilizers, and for frost protection. In some cases the water is heated before it passes to the nozzle lines.

It makes little difference how perfect a system of irrigation equipment one may have installed, or how smoothly the pump works, or what a beautiful spray the nozzles throw on the crop if the returns are not sufficient to justify the outlay. This suggestion raises the questions of cost and of gain in market value of the crop. The first cost for equipping an acre is stated by manufacturers to be in the neighborhood of $125 to $150, making use of new pipe. Some men have economized in various ways and have achieved the desired result at lower cost, although many figures that are given are misleading because the very important labor of the owner in installing the system has been neglected.

It requires 27,152 gallons of water to cover an acre 1 inch deep. This amount of water is applied through ½-inch nozzles at the usual spacings in eight and one-half hours. Water may be pumped ordinarily at 2 to 6 cents a thousand gallons.

Many growers can give very inspiring figures as to the results that they have secured by means of irrigation equipment. One well-known New Jersey grower is reported on first-rate authority to have secured twenty-five tons of beets to the acre and 620 bushels of potatoes from the same area. A crop of onions worth $1,500 has been taken off a 5-acre piece early enough to permit a later crop of Golden Self-blanching celery to be matured. Another grower reports that an outlay of $300 to $400 saved several thousand dollars worth of celery, whereas an unwatered acre and a half was a complete failure.

The Ontario Agricultural College reports experiments as follows:

	Irrigated.	Non-irrigated.
Maturity—		
Leaf	June 22	July 4
Head	July 10	July 26
Weight of crop—		
Leaf	20 lbs., 5 ozs.	11 lbs., 3 ozs.
Head	25 lbs., 15 ozs.	9 lbs., 1 oz.
Quality	Fine	Bitter

At the outset it was pointed out that the heavy cost involved in making conditions favorable for crop-production renders it almost essential that vigorous measures be taken to prevent loss by drought. Now that the possibilities and advantages of irrigation have been indicated, it is well to emphasize the importance of making every other condition favorable. If every factor is favorable except the moisture factor and one other, and money is invested in irrigation, and the other factor prevents the maturing of a profitable crop, the situation of the grower is worse than before by the amount of his new investment.

An application of water equal to an inch of rain over an acre requires 27,152 gallons, as has been said.

To deliver this water, No. 1 Skinner nozzles with pressure of forty pounds should be placed 4 feet apart in the line and the lines should be 56 feet apart; nine hours and twenty-three minutes at forty pounds pressure is the time required. The disharge for each nozzle is 24.1 gallons a minute.

Ninety-four and two-tenths feet of elevation gives forty pounds pressure.

A four horse-power gasolene engine and duplex pump will deliver approximately 100 gallons a minute at thirty pounds pressure, at a cost of roughly 10 cents an hour.

A 2½-inch pipe will deliver 100 gallons a minute at a distance of 100 feet, and a 3½-inch pipe is required for distances between 500 and 700 feet.

With No. 1 outdoor nozzles, a nozzle line 150 feet long may be composed entirely of ¾-inch pipe.

A line 250 feet long needs 100 feet of ¾-inch and 150 feet of 1-inch pipe.

A line 700 feet long needs 90 feet of ¾-inch, 160 feet of 1-inch, 175 feet of 1¼-inch, 175 feet of 1½-inch and 100 feet of 2-inch pipe. PAUL WORK.

ISABÈLIA (Isabel, Comtesse d' Eu, patroness of horticulture). *Orchidàceæ*. One Brazilian creeping epiphyte, 1-lvd., with small reticulated pseudobulb, said to require treatment of maxillaria. *I. virginàlis*, Rodr. Fls. white, solitary; sepals nearly equal, the middle one free, the others connate and produced into a spur; petals small, narrow, the lip upright, entire. O. 1911, p. 8.—Apparently little known in cult. L. H. B.

ÌSATIS (ancient name, of obscure meaning). *Cruciferæ*. Herbs, for ornament and for dyeing.

Annual, biennial, perennial; erect, branching, glabrous or pubescent or rarely tomentose: lvs. undivided, the upper ones clasping and auricled: fls. small, yellow, many in lax racemes, without bracts; sepals and petals 4: pod large and mostly flat, pendulous, linear to oblong or obovate or even nearly circular, indehiscent, strong-ribbed on either side, 1-seeded, the stigma sessile; radicle mostly incumbent.—Species about 50, Eu., N. Afr., Asia.

This genus includes the dyer's woad, *I. tinctoria*, formerly cultivated for a blue dye but no longer advertised. Cæsar relates that the ancient Britons used the woad for staining their bodies, and the word Britain itself comes from an old Celtic word meaning painted. Before indigo became common in Europe, the dyer's woad produced the chief blue coloring matter for woolen cloth. The introduction of indigo in the seventeenth century destroyed this important industry, not without opposition. Dioscorides and Pliny mention both the dyer's woad and indigo.

tinctòria, Linn. Rather tall; glabrous or nearly so, and glaucous: biennial, 1½–3 ft.: st.-lvs. lanceolate, entire, sessile, somewhat arrow-shaped: fls. small, yellow, borne in early summer, on panicled racemes: instead of a pod, opening lengthwise by valves, it has a closed fr. like the samara of an ash, 1-celled, 1-seeded, indehiscent, wing-like. S. E. Eu. and probably eastward; now widely naturalized in Eu.—The cult. form is sometimes distinguished as var *sativa*, DC., with broad glabrous lvs.

glaûca, Auch. Perennial, glaucous, the st. thick, 2–4 ft., and bearing a large panicle: lvs. glabrous, entire, the radical oblong and the cauline very small: fls. yellow: pod about ½in. long, linear-oblong, obtuse or truncate-retuse. Asia Minor, Persia. G.M. 47:492.—Offered abroad.

I. Boissieriàna, Reichb. Annual, 12 in.: basal lvs. cuneate-oblong, toothed; upper lvs. entire, oblong: fls. yellow: pod pubescent, various. Turkestan. L. H. B.

ÍSCHARUM: *Biarum*.

ISCHNOSÌPHON (name refers to the narrow corolla-tube). *Marantàceæ*. Upward of a dozen calathea-like perennial herbs or bamboo-like plants of S. Amer., belonging to that group of the family having 1-celled rather than 3-celled ovary (and so differing from Calathea and Phrynium, and agreeing with Ctenanthe and Maranta, but differing from the last two in having a solitary staminodium). Lvs. large, coriaceous or soft: fls. geminate, in an elongated cylindrical spike; sepals 3, free, long-linear; corolla-tube narrow and much elongated, the lobes lanceolate or oblong-lanceolate; stamen-tube nearly obsolete; staminodium petal-like, large, obovate: caps. elongated, very unequally 3-valved, 1 valve dehiscent. Tall often branching plants with leafy sts., very little, apparently, in cult. They are treated as calatheas or marantas. **I. leucophæus,** Koern. (*Maránta màjor* and *Calathèa màjor*, Hort.). Two feet and more, nearly simple: basal lvs. ovate or oblong, acuminate, more or less cordate at base, farinose beneath: racemes simple, about 6, slender; corolla white or rose-colored, the tube upward of 1 in. long, the lobes oblong-lanceolate. Panama to Brazil. **I. bambusàceus,** Koern. (*Calathèa bambusàcea*, Poepp. & Endl.). Bamboo-like, becoming 30 ft. or more tall, much branched, with graceful shoots: lvs. small (3–5 in. long), somewhat ovate-lanceolate, attenuate-acuminate, green above and glaucous beneath: raceme short and sessile, solitary or twin; corolla-lobes whitish yellow, lanceolate, the tube exserted and about 1 in. long. Peru. L. H. B.

ISLAND DEPENDENCIES, Horticulture in. The island dependencies of the United States comprise territories in both Atlantic and Pacific waters. They are all tropical, however, and therefore may be considered together horticulturally. The islands that call for special treatment in this work are Porto Rico, Hawaii, Philippines, Guam, and the American part of the Samoan group (Tutuila). The inclusion of these wide-scattered territories in this Cyclopedia brings in the flora of the tropics, although it is intended to discuss, in the regular entries in the different volumes, only the most important or outstanding species; to endeavor to comprise all cultivated plants that might find home or lodgment in these islands would be to describe practically all tropical subjects, and this would be far too large an undertaking for a work of this character.

The geographical articles in this Cyclopedia are gathered under three heads,—British North America, Island Dependencies, North American States. In the last symposium will also be found an account of Panama in its horticultural relations. All these articles should give the reader a comprehensive view of the

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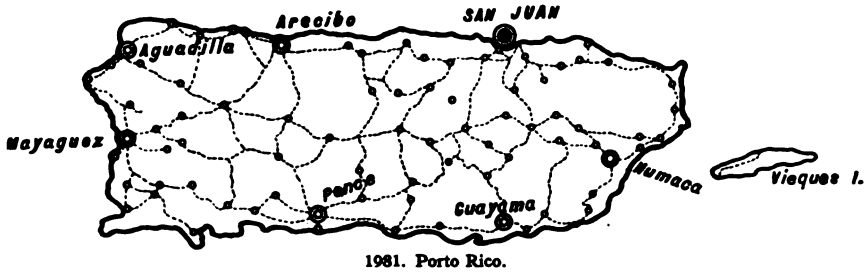
horticultural possibilities of the North American continent north of Mexico, and of the tropical territories that have become attached to the United States. They depict a surprising range of natural conditions and resources, and indicate a very real horticultural conquest of a relatively new part of the earth's surface.

Porto Rico.

The island of Porto Rico (Fig. 1981) is rectangular in form, about 100 miles long and 35 miles wide. Its area is about one-twelfth of that of Cuba and nearly the same as that of Jamaica. It lies in 18° north latitude and 65° to 67° west longitude, which places it 600 miles due east of Jamaica. Although Porto Rico is mountainous, the mountains are low and rolling, but few of the short ranges exceed 2,000 feet in elevation, making practically all of the area suitable to some branch of agriculture. The low plains extending a few miles inland from the sea and reaching for the most part around the island, and the numerous plains and low rolling areas between the ranges of mountains, afford a variety of rich soils, of temperatures and of elevations, which has developed extensive horticultural interests and operations. The rainfall is generally considered heavy, although the sea-breezes and varying temperatures of different elevations cause a great difference in rainfall between different sections. In all parts of the island, excepting the western and southern areas, the rainfall is fairly well distributed through the year, although the season for heaviest rainfall is from May until December, which is the only season when the western and southern sections have an abundance of rain. In sections in which drought continues through the winter months, irrigation is often employed. The elevated sections are well supplied with rains and are drained by numerous ravines, creeks and small rivers, which afford an abundance of power and opportunity for irrigation. In inches, the annual rainfall varies from 37, in the southwestern parts of the island, to 135 on the higher mountains in the northeastern part, the average for the island being 77.



1981. Porto Rico.

The climate is healthful and delightful, the temperature being almost ideal. Because the island is small and has a moderate elevation, and lies in the zone of the trade-winds, the climate is uniformly warm and comfortable. The coolest month is January, which has an average temperature of 73°, while August, the warmest month, has an average of 79°. The mean daily temperature is quite constant, the change from day to night temperature being 20° to 25°. The average daily maximum temperature along the coast in summer is 87° and the daily minimum temperature in inland sections is 65°.

The population of the island, according to the census of 1910, was 1,118,012, which allows 320 persons to the square mile. All persons but a small percentage are engaged in agricultural pursuits.

The soils of Porto Rico are of many types, and grade from very heavy clays to light sandy loams. The hills and mountains are, for the most part, red clays, while the valleys between them and the coastal plain are heavy dark loams, grading in some places into sandy loams. While the soils are usually fertile, many crops respond to a complete fertilizer. There are practically no swamps in Porto Rico, although during the season of excessive rains ditching is necessary to drain large areas of the level coastal plains. Except in areas near the sea surface, drainage is good; however, poor drainage of the subsoil in some areas is a hindrance to horticultural crops.

Horticulturally the island is divided into three sections: The narrow sandy plains which skirt the coast are well adapted to coconut culture. The slightly elevated plains and low rolling lands between the flat coastal plains and the more elevated portions of the island on the north have been proved to be well suited to pineapple and citrous fruit-growing, while the highest mountain ranges that traverse the central part of the island are devoted almost entirely to coffee. Sugar-cane growing is confined mostly to the heavy soils of the coastal plains.

The leading horticultural crops are citrous fruits, coffee, coconuts, pineapples, vegetables, bananas and other tropical fruits. The agricultural industries are sugar-cane, tobacco-growing and stock-raising.

The most attractive field for the horticulturist in Porto Rico is citrus-culture. This industry has made wonderful progress since the American occupation, over 3,000 acres now being given up to it, while there were no commercial groves at the time of the occupation. Grapefruit, oranges, lemons, limes and other less important citrous fruits are cultivated, although attention is given mostly to grapefruit and oranges. In the area adapted for citrus-culture, the temperature is ideal for tree-growth and fruit-production. Care must be taken, however, in selecting the orchard site to secure subsoil which will drain well and areas protected from the winds. The trade-winds are in some places constant enough to hinder a normal tree-growth and to prevent the best development of certain fungi which prey on injurious scale insects. Where there is not natural wind-protection, a belt of tall-growing trees is planted on the windward side of the grove for shelter. Several leguminous crops, such as jack beans, velvet beans and cowpeas grow to perfection and are used extensively as cover-crops and green-manure crops.

Four ship lines furnish excellent transportation between the island and New York, the ocean rates being much less a box to New York than from Florida or California.

Grapefruit seems to be especially well adapted to Porto Rico conditions and is receiving first attention among horticultural crops. The trees are very vigorous, come into bearing early and are very prolific. The quality of the fruit is excellent and Porto Rican grapefruit is throughout the year a favorite product in the northern markets. The fruiting season for this crop is very long. The main crop is harvested during the winter and spring months but each week throughout the year Porto Rican grapefruit is offered on the market. Varieties "Duncan" and "Marsh Seedless" are the most popular.

Oranges have been more extensively planted than grapefruit though they do not seem so well adapted to the conditions, and the planting of them has practically ceased. Like grapefruit, the trees bear early and are prolific, and the fruit is of a high quality. Dis-

1982. A native hut in Porto Rico.

eases and insects cause but little damage. Oranges are found growing wild throughout Porto Rico, though most numerous through the western mountains, which are planted to coffee. These wild orange trees, grown under the protection of the coffee shade trees, produce a beautiful clean fruit which matures during the driest season and develops an excellent flavor and quality. These wild oranges are given no culture and the fruit is sold on the tree by the coffee plantation owner to packing firms in the western seacoast towns, who box and ship them to northern markets. Until within late years, unexperienced packers have brought Porto Rican wild oranges into disrepute by shipping great quantities of poorly packed or immature fruit, which reached the market in bad condition. The lack of good roads into the interior of the island prevents the marketing of thousands of boxes of fruit annually and allows quantities of boxes to be bought for a few cents a box. While the wild fruit is handled for the most part by the natives of the island, the cultivated oranges and grapefruit are practically all grown and marketed by Americans.

Pineapples have been one of the most profitable crops in Porto Rico for several years, as the price of the fruit has been high and weather conditions favorable for production. The old Spanish belief that pineapples were not profitable except in the locality of Lajas, a town in the western part of the island, was soon disregarded by the American settlers and at present this crop is found in many parts of the island. The commercial plantings are confined to two varieties, the Cabezona, meaning in English "large-headed," and Red Spanish. The former is grown for canning and the latter for shipping fresh. Most of the Red Spanish variety is grown in sections near Rio Piedras, where the soil is a light sandy loam, and from Bayamon to Arecibo, where the soil is an open, well-drained red sandy loam; however, they grow well in many other locations. The chief demands of the pineapple are well-drained, well-aërated soil, abundance of sunshine and a good supply of complete fertilizer where the surface soil is not naturally rich. This crop is practically free from insects and diseases. The plants are very prolific and can be brought into bearing at any season of the year. As the northern market shows a preference for Porto-Rico-grown pineapples, the industry bids fair to become still more important. Though the practice varies with conditions, the usual cultivation method is to plow the soil and by plow and hand labor work it into beds a few inches high, leaving ditches to afford drainage. The beds are made wide enough to provide for two to six plants set from 12 to 18 inches apart. Of the 10,000 plants to the acre, which is the number usually set, 90 per cent are expected to bear fruit the first crop. Fertilizer is applied at the time of planting and at intervals during the growth of the plant. As the first crop of fruit matures, suckers spring from the base of the plants and produce a second crop. On the most suitable land three or four crops are allowed to develop from suckers, though seldom more than two are considered profitable. The Cabezona variety is grown for canning principally, although profitable shipments of fresh fruit have been made. In the western end of the island, and especially in the area from Lajas to Mayagüez, the conditions are especially adapted for the growing of this variety. In this area a great quantity of the fruit is grown and sold to canners by the ton.

1983. A grapefruit grove in Porto Rico.

FRUIT SHIPPED FROM PORTO RICO TO THE UNITED STATES AND FOREIGN COUNTRIES DURING THE TWELVE YEARS ENDING JUNE 30, 1912.

Year	Oranges	Pine-apples	Canned pine-apples	Coco-nuts	Grape-fruit	Other fruits
1901....	$84,475	.....	.....	$8,334	.....	$16,992
1902....	51,364	.....	.....	12,720	.....	9,898
1903....	230,821	.....	.....	326	.....	61,956
1904....	352,646	.....	.....	.....	.....	81,214
1905....	125.422	.....	.....	.....	.....	130,478
1906....	295.633	$27,826	$42,186	129,793	.....	7,420
1907....	469.312	64,831	63,519	174,957	$7,586	3,737
1908....	630.720	172,779	98,203	206,704	44,535	11,320
1909....	401,912	442,780	117,830	204,498	76,310	18,154
1910....	582,716	555,044	106,587	218,870	162,749	9,851
1911....	703,969	641,291	149,744	258,169	309,698	11,123
1912....	584,414	684,774	258,671	308,883	525,048	15,972

At the present time, the coffee industry is flourishing, as both weather conditions and prices are favorable. Aside from the influence of changing tariffs, practically the only drawback to this great industry is severe storms which once in a series of years visit the island, usually coming in the coffee-ripening season. Porto Rican coffee is not well known in the United States, but throughout the West Indies and in some European countries it is a favorite among coffees and brings high prices, selling for several cents a pound higher at wholesale than Brazilian coffee. The mountainous region of the central and western part of the island is given up mostly to coffee and affords a splendid field for its culture. The best coffee in Porto Rico grows on the well-drained upland areas and reaches its highest perfection at 1,500 and 2,000 feet. Throughout this coffee-growing area, the air is always cool and refreshing and conditions for health are almost ideal. As the coffee is prepared for market on the plantations and can be transported to the seacoast markets or to the main roads leading there by pack animals, the lack of good roads does not hinder this industry as it does others in this section. Throughout the area devoted to coffee the land is cheap, in many localities not exceeding $30 an acre. Coffee may be grown in Porto Rico

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for 5 cents a pound and on a good plantation from 300 to 400 pounds an acre is an average crop. At the present price of 15 cents a pound, handsome returns are realized. Practically all plantations devoted to this crop are large and under Spanish or Porto Rican management. It is a rare exception when any fertilizer is applied to coffee. As the plantations are rolling and the trees set but a few feet apart, no animal cultivation is given and the only cultural work is confined to shallow hoeing and weeding.

There is no crop in Porto Rico which yields such regular and satisfactory returns as the coconut palm. Without cultivation or fertilizing, the trees bear good crops of large nuts which bring first-class prices in the United States markets. The narrow strip of sandy coastal plain, which rarely exceeds ½ mile in width and for the most part skirts the island, is ideal for coconuts, as the sandy loam affords perfect drainage, which is the principal requisite for this crop. Most of the suitable land has been planted and is in bearing. The trees are planted from 25 to 30 feet apart each way and bear in five to eight years, depending on the fertility of the land. The area devoted to coconuts in Porto Rico is small, and practically all of the product is exported to the United States, the only demands at home being for drinking the water from the half-mature nuts and for making coconut-oil and its products.

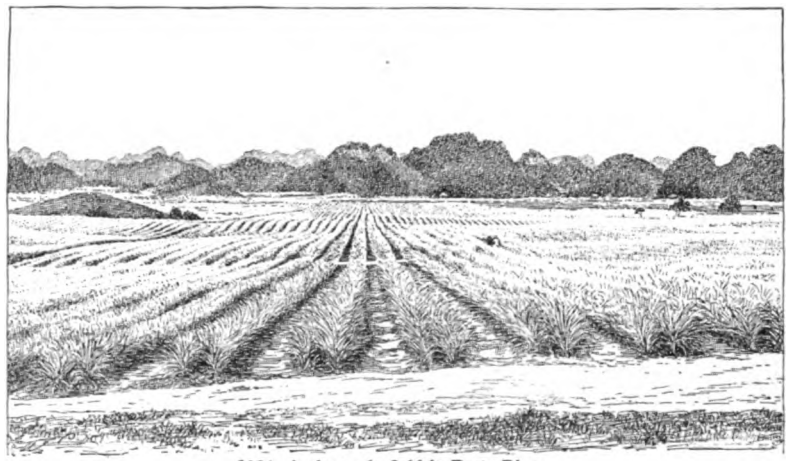
The temperature in Porto Rico is ideal for vegetable-growing, but injurious influences of excessive rains and prolonged droughts, together with the rather heavy poorly aërated soils, make commercial vegetable-growing practically a failure so far as shipping to foreign markets is concerned. When irrigation is practised, excellent crops of lettuce, radishes, turnips, carrots, tomatoes, peppers, cucumbers, and so on, are grown, but usually at a cost so high that export is not profitable. Large quantities of vegetables are grown and sold at a very low price for home consumption. The most productive crops and those that can always be depended upon are the starchy root crops including ñame, yautias, dasheens and yuca. These products are not exported, although they are grown by every Porto Rican family on the island where the farm or dooryard is large enough for them. One exception is yuca (Manihot) which is grown by commercial firms and the starch extracted in a modern factory near Bayamón.

Bananas are found growing in all parts of the island and form a part of the daily diet of both Porto Ricans and foreigners. They are grown in dooryards, along streams, in orchards, as windbreaks for young citrous trees, as shade for newly planted coffee trees and throughout the hilly coffee plantations. A number of the best varieties, including yellow- and red-fruited kinds, and those for eating raw and for cooking, may be found in plenty on nearly every farm.

As is true with other West Indian Islands, the mango is the most popular fruit. It is truly the apple of the tropics. Until late years but little has been done to improve the quality of mangoes in Porto Rico, and there are but few of the choice strains growing here. The favorite kinds grow in the Mayagüez district. The fruiting season continues for several weeks during which time this fruit is one of the chief articles of food among some of the poorer classes. No effort is made to export the mango. At home they are used only in the fresh state except that fully grown green fruit is made into sauce which resembles apple sauce very closely, both in appearance and flavor. No orchards of native mangoes are cultivated, as the trees grow wild and produce well with no care. The federal experiment station and a few commercial fruit-growers are introducing and distributing superior varieties from other countries, notably East India and the Philippine Islands. These imported varieties are thrifty and the fruit of a very superior quality.

The avocado tree requires a well-drained soil and prefers one of a rich neutral loam. It does not grow well on all parts of this land and reaches its heaviest production on the west end of the island near Isabella and Aguadilla. The fruits are so plentiful, however, that those of highest quality may be purchased in markets at 1 or 2 cents each during the few weeks of harvest. Among other fruits that may be found in quantity in the markets of the island are mamey, anona, caimito, nispero, papaya and guayaba.

Among the agricultural industries, cane- and tobacco-growing and animal-production are important undertakings. Most of the cane is grown on the low coastal plain which reaches around a large part of the island and in some places is several miles in width. In these areas the soil is well adapted to the industry and as the temperature is even and never low a good yield can be depended upon each year. In 1901, the exports of sugar were less than 70,000 tons; in 1911 they were nearly 323,000, and during 1912, 367,000,—five times greater than they were eleven years ago,—and they are still increasing, having advanced 10 per cent during the past year (1913). The external sales of this product yielded $31,500,000 against less than $5,000,000 in 1901.



1984. A pineapple field in Porto Rico.

Tobacco is grown to some extent in all parts of the island, though most of the Porto Rican output is grown in the vicinity of Cayey, Caguas and Gurabo. In these sections an excellent product is grown and it is the chief industry. Quoting from the report of Governor Colton for 1912,—"The output of cigars was more than fourteen times greater than in 1901, since which year it has continuously increased until the sales of 1911–12 reached 281,000,000, an increase of 10,000,000 over the preceding year. Of these 170,000,000 were consumed upon the mainland and 111,000,000 in Porto Rico."

Great interest is shown by the people of the island in promoting scientific agriculture and agricultural education. Institutions engaged in this work are the Federal Experiment Station, an Agricultural College, a Sugar Producers' Experiment Station supported by the sugar-growers, and a Board of Agriculture.

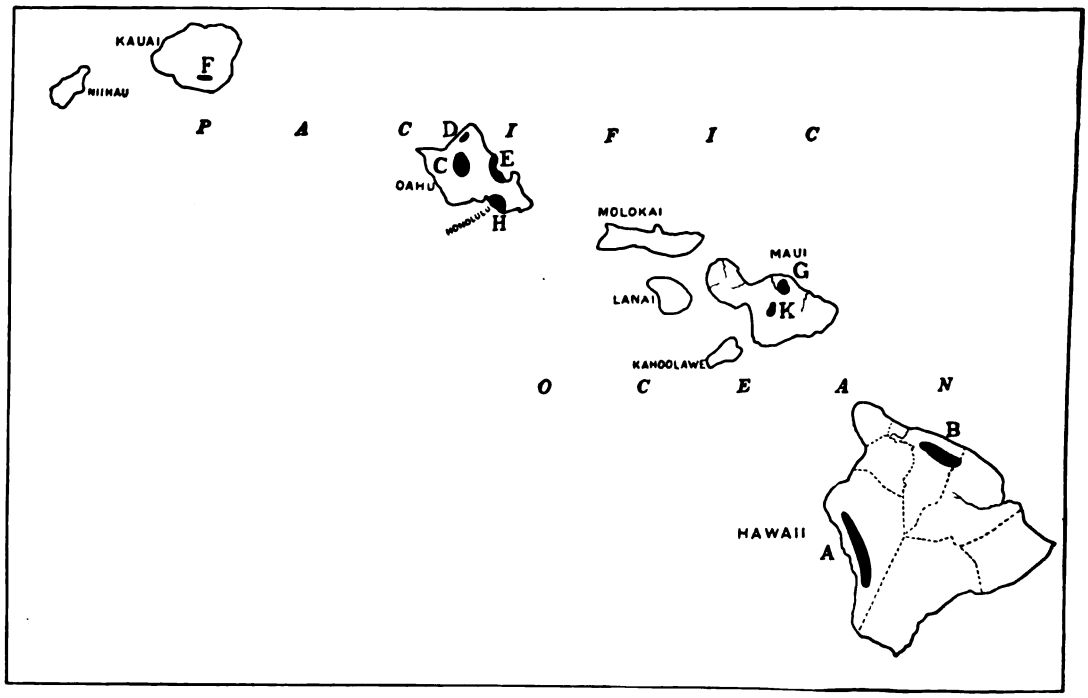
C. F. KINMAN.

Hawaiian Islands.

The group known as the Hawaiian Islands (Fig. 1985) is located about 2,100 miles from San Francisco in a southwesterly direction. These were named the Sandwich Islands by the discoverer, Captain Cook, but this designation was abandoned many years ago for the original native name, taken from that of the largest member of the group, Hawaii. Since annexation to the United States, the Hawaiian Islands have been officially known as the Territory of Hawaii. Disregarding small and unimportant islands, Hawaii lies between the parallels 18° 50′ and 23° 5′ north latitude and between the meridians 154° 40′ and 160° 50′ west longitude. The five most important islands have an area of about 6,200 square miles, or rather less than that of Massachusetts, and extend about 380 miles from northwest to southeast.

It is hardly correct to speak of the climate of Hawaii, for there are so many different climates in this small area. The extent of the rainfall, for example, which forms so important a factor in the horticultural conditions of a country, is decidedly divergent in different regions and even in localities within a few miles of each other. To understand the climatic conditions, it is necessary to recall that these islands are of volcanic formation, their central parts and the larger part of their area being occupied by rugged and high mountains, descending sometimes gradually, sometimes precipitously to the sea and with valleys or tablelands lying between the ranges and narrow plains near the coast. Being in the path of the northeast trade-winds, the windward side of the islands receives an abundant rainfall throughout the year, while the southwest shores are comparatively dry. Thus, at Honolulu, on the southwest shore of Oahu, the annual rainfall averages about 38 inches, while that of the city of Hilo, on the windward side of the island of Hawaii, measures 12 feet. Even within a very narrow range, as, for example, the limits of the city of Honolulu, there is great variation in rainfall, certain localities receiving frequent rains throughout the year, while others only 2 or 3 miles distant practise irrigation constantly. Some of the great sugar-cane plantations depend wholly upon the natural supply of water, while others could not grow cane at all without their expensive systems of artesian wells and irrigation.

Similarly there is a great variation in the temperature in different parts of this small but important country, but exceedingly slight variations with the changing seasons. The windward side is cooler than that which is sheltered by the mountains, but in no part of the islands is the heat so intense as would be expected from their location within the tropics. Only rarely, in the hottest localities, does the mercury rise to 90° F. Again, the variation in elevation from sea-level to many thousand feet gives a like variation in temperature, so that some of the mountains of the largest island are covered with snow during a part of the year. In short, so far as climate is concerned, the Hawaiian Islands offer all that could be asked for great and diversified horticultural industries.



1985. Hawaiian Islands.

Only a small proportion of the total area of the country is suitable for cultivation. The lands lying near the shore and along the lower slopes of the mountains are occupied almost exclusively by sugar-cane, with an occasional banana plantation and with rice and taro growing on the low valley bottoms which can be kept submerged for these aquatic plants. The cane-belt rises to an elevation of only a few hundred feet on some plantations, limited by the cost of pumping water, but in some other localities it extends to nearly 2,000 feet. These lower lands are well adapted to the growth of tropical fruits and such, together with many of the vegetables and flowers of the temperate and tropical zones, may be found in gardens. Above the cane-belt are lands also suited to such tropical crops as pineapples and coffee, and still higher there are some areas where apples, peaches, plums and many temperate-zone fruits may be grown, although none of these crops has become the basis of an industry. The regions on

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the map, designated by the letters *A* and *B* are the two most noted coffee-producing sections; *C*, *D*, *E*, *F*, and *G* are localities in which pineapple-growing has become an important industry; *H*, indicating the district lying about the city of Honolulu, locates the area where there is probably the greatest variety of introduced horticultural plants; at *K*, known as the district of Kula, on the Island of Maui, potatoes, corn and other temperate-climate crops have been grown for many years and were shipped to California to supply the needs of the gold-seekers in 1849 and the years following before the agricultural industries of that state were developed.

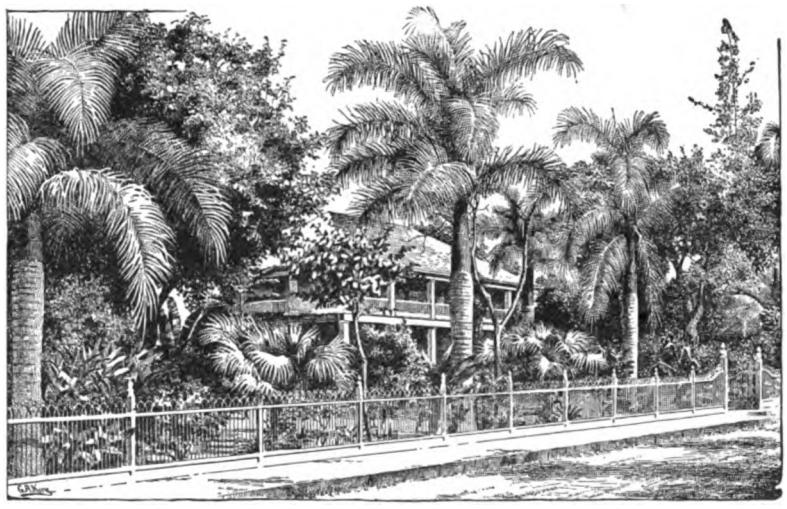
The growing of pineapples is not only the leading horticultural pursuit but ranks next to sugar-production among the industries of the Islands. Hawaii is widely known for its pineapples. It is only within the last decade that this crop has risen to large importance. The beginnings of the industry were near Honolulu and the first large plantation was about 14 miles from that city in a northwesterly direction, on the foothills sloping from the Koolau Mountains. A little farther to the northwest a small colony of American farmers settled at Wahiawa on virgin lands, said to be useless except for grazing. They found that the pineapple attained perfection on their lands and the industry began to extend rapidly from that center. Several thousand acres have been planted on the foothills and the plains between the mountains, and considerable areas have been devoted to the crop on the north and east sides of the island. Other centers are to be found as indicated above on Maui, Kauai and more recently on Hawaii. Only a small fraction of the crop is marketed as fresh fruit, the greater portion being sold in the can. Large canneries are in operation in all the centers of production, owned and controlled by the larger plantations. The price paid for first quality pines is about $20 a ton. The total output for the season of 1912 is estimated at a little over 1,000,000 cases of two dozen cans each and valued between $3,000,000 and $4,000,000. At the present rate of planting it appears that the annual pack will again be doubled within a few years. The products of the pineapple cannery include not only canned fruit in several forms as sliced and grated pineapple but recently the juice is being bottled in much the same way as grape juice. A syrup is also made from the juice and one factory is engaged exclusively in this business.

The fresh fruit trade is also increasing and shipments are made by nearly every steamer to the mainland, where they are distributed to all parts of the Pacific states and a few are sent to the East. Carload shipments have been made to the great central markets, but the Hawaiian pineapple-growers have devoted their attention chiefly to the more conservative method of disposing of their product as canned fruit, which has found a ready market in the United States.

Most of the pineapples are produced under the plantation system, the units varying from a few hundreds to several thousands of acres each. A few individual planters are in the business and at the present time their number seems to be increasing through the opening of homestead lands by the government.

The pineapples are grown just above the cane-belt, but in places in which water is insufficient for cane, the pines extend almost to sea-level. The soil upon which they are grown is usually rather a heavy loam, subtended often with a clay substratum. Since the plant will not endure standing water, drainage is one of the important problems. Underdrains of tile or rock are not in use, but surface ditches or depressions are provided to carry off the surplus water of heavy rains. Deep plowing is practised to break the almost impervious layer which develops just beneath the cultivator teeth. The use of giant powder for the purpose is now being tried. Both these practices can be conducted only when the plants have been removed from the fields, which it is necessary to do in preparation for replanting every four or five years.

Another problem of the pineapple-planter is to avoid excessive manganese in the soil, for the plant is very sensitive to an excess of this element. A few places in the pineapple region have been found where soils, otherwise excellent, have proved useless for this crop. It is easy to discover its presence by chemical analysis and usually by the appearance of the soil which, therefore, can be avoided or devoted to other crops less sensitive to manganese.



1986. Hawaiian vegetation. Showing the royal palm as it grows in Honolulu.

The method of culture is to set the plants in single, double or triple rows and cultivate thoroughly between them by mules and with hoes. Sheds are not thought of in Hawaii for there is never frost in the pineapple area. The first crop matures in sixteen to twenty-four months and is followed by a rattoon crop a year later. A second rattoon and occasionally a third may be taken from the field before plowing up the old plants and replanting. The Smooth Cayenne is the chief variety in cultivation, but another smooth-leaf variety has become somewhat mixed with the stock and all have passed usually for Cayenne. These are the only varieties now in commercial cultivation in Hawaii, although very many kinds have been tested and some continue in gardens.

Banana-growing is an older industry but it has not made as rapid progress as the pineapple. For several years the export trade has run from about 180,000 to 200,000 bunches a year, netting the growers about 50 cents a bunch when prices are good. Banana-growing for export is confined almost entirely to Oahu, since this is the only island which enjoys frequent and direct steamship communication with the mainland. The island of Hawaii ships a few bananas on its regular boats but these do not run with sufficient frequency to encourage extensive plantings. The fruits are

shipped to San Francisco and practically all are consumed in that market or those immediately around the Bay. The bananas are grown in small plantations varying in size from 2 to 50 or more acres. They are owned and operated chiefly by the Chinese who unite in companies for the purpose. The lands occupied are generally at a low elevation, for the commercial banana does not prosper, in most parts of Hawaii, above 1,000 feet, and it is important, with so bulky a product, to be near the shipping port or a connecting railway. Most of the bananas, therefore, are grown along the line of the railway which circles one end of Oahu, or in the immediate vicinity of Honolulu. The plants are set at distances varying from 8 by 8 feet to 12 by 12 feet and receive water by irrigation, by natural rainfall or by capillarity when the plants are grown on ridges thrown up in swamp-lands with wide canals between the ridges. The Chinese or Cavendish banana (*Musa Cavendishii*), almost exclusively, is grown for export, although the Jamaica or Martinique variety, common in all the American markets, has been introduced and distributed. There are many varieties of bananas that are indigenous to Hawaii, and some of these are being cultivated in yards and gardens. One class of these varieties, known as the Maoli group, is grown in a small way commercially and finds a ready sale in the local market as a banana for cooking. These, when well baked or fried, are far more delicious than any of the bananas found in the American markets and a trade in them should be developed, for they are well adapted for shipping.

Coffee-growing is conducted as a small industry and there are a few rather large plantations. About fifteen years ago the trees were planted quite extensively and it appeared as though the crop would be exceedingly profitable; but cheap coffee imported from Brazil depressed prices in the American markets to a degree which caused the uprooting or abandonment of most of the plantings. A few of the original planters continue in the business and produce a high grade of coffee which has made a good reputation. The name "Kona" coffee has been applied to much of the product because the district of Kona on the island of Hawaii is one of the leading coffee districts. The total output for the year ending August 15, 1911, was about 5,200,000 pounds. The coffee-growing districts lie chiefly above the cane in localities which are well supplied with rain, as along the northeast side of Hawaii and in Kona on the west side.

Citrous fruits are found in yards and gardens in many varieties of orange, lemon, lime, pomelo, shaddock and other species, but there are few citrous orchards. Seedling oranges are shipped to Honolulu, in fifty-gallon casks, from Kona, where they grow in a half-wild and uncultivated condition. A few limes are also sent to this market. The oranges are of excellent flavor but because of inferiority in appearance and packing they sell at low prices.

The avocado, sometimes erroneously called the alligator pear, is found in nearly every dooryard and garden and recently a few orchards have been planted. The fruit is always in demand and sells at high prices even in the local market, good fruits bringing from 8 to 15 cents each at retail or from 60 cents to $1 a dozen on the trees. Previous to the advent of the Mediterranean fruit-fly (*Ceratitis capitata*), avocados were shipped to California and in experiments conducted by the Hawaii Experiment Station, these fruits were sent in refrigeration to Chicago and arrived in good condition. They sold at wholesale in San Francisco for about $2.50 a dozen. Satisfactory methods of propagating the best varieties and of handling the fruit were completed only a short time before the Mediterranean fly made its appearance and interest was being manifested in the planting of orchards of avocados for the marketing of the fruit on the mainland. Although the insect infests the avocado very rarely, it has been found in a few instances, which fact has placed this fruit on the quarantine list at the California ports. For these reasons, the growing of avocados, which at one time seemed likely to develop into an important industry may not be widely extended until the status of the pest is changed. There is room, however, for considerable extension to supply the growing local market and the culinary departments of ocean liners.

The mango is even more widely distributed than the avocado and prospers in a great variety of soils up to 500 or 600 feet. It is found even higher than this but does its best in the warm and dry lowlands if irrigated. There are many varieties, including some superb sorts of local origin as well as the renowned East Indian kinds and Cochin-China type. Of the Indian varieties, the Pirie gives most promise, but several others, as Mulgoa, Alphonse, Jemshedi and Brindabani, have done well. The Smith and the Wooten are two of the

1987. A banana plantation in the Hawaiian Islands.

best of local origin. None of these better varieties is widely disseminated, partly on account of their recent introduction and partly because ready methods of rapid multiplication have not long been developed. For this reason, it is impossible to find any choice mangoes in the local markets, the few that are sold being disposed of privately at about 5 cents a fruit. This condition will not continue for many years, for the choice sorts are now being disseminated. The mango also is under quarantine on the mainland because of the Mediterranean fruit-fly, but the best varieties could be profitably grown for the local markets and for supplies to passenger ships. Certain fine varieties are quite resistant to the attacks of the fly.

Guavas (*Psidium Guajava*) cover the hillsides, the jungles in many places being composed chiefly or wholly of this tree. The wild fruit is gathered and used in the making of guava-jelly and jam, the greater part of which is consumed locally. A few selected varieties of this species and of the strawberry guava (*P. Cattleianum*) are cultivated in gardens.

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The papaya (*Carica Papaya*) is the most important breakfast fruit in Hawaii and is grown in almost every dooryard as well as in small orchards. It is of very easy culture, coming into bearing within a year from planting and continuing for several years to produce good fruit on almost any well-drained soil. For this reason it is a fruit for the rich and the poor alike. The tree is propagated chiefly by seeds and as there has been very little attempt to keep strains pure, there is a very wide variation in flavor and other qualities. The difficulty of keeping pure strains has been complicated by the fact that most papayas are dicœcious and it is impossible to know the inherent qualities of the male trees. But fortunately there is a hermaphrodite type and with this there is hope of establishing reasonably stable varieties of good quality.

A great variety of tropical and semi-tropical fruits and nuts is to be found in these islands. A list of some of the more important of these is as follows:

Ananas sativus (pineapple).
Artocarpus:
- (a) Artocarpus incisa (bread-fruit).
- (b) Artocarpus integrifolia (Jack-fruit).

Annona:
- (a) Annona muricata (soursop).
- (b) Annona squamosa (sweet-sop or sugar-apple).
- (c) Annona reticulata (custard-apple or bullock's heart).
- (d) Annona Cherimola (cherimoya).

Anacardium occidentale (cashew).
Averrhoa Carambola (carambola).
Ægle Marmelos (Bael fruit; elephant apple; or Bengal quince).
Achras Sapota (sapodilla).
Aleurites Moluccana (kukui nut).
Areca Catechu (betelnut).
Bunchosia sp.
Citrus:
- (a) Citrus sinensis (sweet orange).
- (b) Citrus Aurantium var. Amara (sour or Seville orange).
- (c) Citrus Limonia (lemon).
- (d) Citrus sp. (rough lemon).
- (e) Citrus aurantifolia (lime).
- (f) Citrus grandis (pomelo or grapefruit).
- (g) Citrus grandis (shaddock).
- (h) Citrus nobilis (Mandarin orange).
- (i) Citrus japonica ("China" orange, or kumquat).
- (j) Citrus Medica var. genuina (citron).
- (k) Citrus mitis (Calamondin orange).

Canarium commune (pilinut).
Carica:
- (a) Carica Papaya (papaya).
- (b) Carica quercifolia (dwarf papaya).

Chrysophyllum Cainito (star-apple).
Casimiroa edulis (white sapota).
Coccoloba uvifera (shore-grape).
Cocos nucifera (coconut).
Cocos Gaertneri
Claucena Lansium (the wampi).
Diospyros decandra (Cochin-China persimmon).
Durio zibethinus (durion).
Eriobotrya japonica (loquat).
Eugenia:
- (a) Eugenia malaccensis (mountain apple).
- (b) Eugenia Jambos (rose apple).
- (c) Eugenia uniflora (Cayenne or Surinam cherry).
- (d) Eugenia sp. (1, white water apple).
  Eugenia sp. (2, red water apple).
- (e) Eugenia myrtifolia (brush cherry).
- (f) Eugenia Jambolana (black plum or jambolan plum).

Ficus Carica.
Garcinia:
- (a) Garcinia Mangostana (mangosteen).
- (b) Garcinia sp. (African mangosteen).

Hibiscus Sabdariffa (roselle).
Inocarpus edulis (mape, or Polynesian chestnut).
Lucuma nervosa (egg-fruit).
Malpighia glabra (Barbados cherry).
Musa (banana):
- (a) Musa Cavendishii (Chinese banana).
- (b) Musa sapientum (including practically all other common edible bananas).

Mangifera indica (mango).
Mammea americana (mammee apple or St. Domingo apricot).
Monstera deliciosa (delicious monster).
Macadamia ternifolia (Australian nut).
Morus alba (the mulberry).
Morus nigra (the mulberry).
Morus multicaulis (silkworm mulberry).
Nephelium (genera Litchi and Euphoria):
- (a) Nephelium Litchi (litchi).
- (b) Nephelium Longana (longan).

Noronhia emarginata.
Olea europæa (olive).
Persea gratissima (avocado).
Passiflora (the passion flower fruits):
- (a) Passiflora lauriflora (yellow water-lemon).
- (b) Passiflora edulis (purple water-lemon).
- (c) Passiflora quadrangularis (granadilla).
- (d) Passiflora alata (granadilla).

Psidium (guava).
- (a) Psidium Guajava (sweet, sour, and lemon guavas).
- (b) Psidium Cattleianum (strawberry guava).

Phœnix dactylifera (dates).
Punicum Granatum (pomegranate).
Phyllanthus acida (Indian gooseberry).
Phyllanthus Emblica (emblic myrobolan).
Physalis peruviana (poha).
Rubus Macraei (akala).
Rubus hawaiiensis (Hawaiian wild raspberry).
Spondias dulcis (Wii fruit, or Tahitian Vii apple).
Terminalia Catappa ("Kamani" [foreign] tropical almond).
Tamarindus indicus (tamarind).
Theobroma Cacao (cacao).
Vitis (grape: chiefly V. vinifera and V. labrusca).
Vanilla planifolia (vanilla).
Vaccinium reticulatum (ohelo).
Zizyphus Jujuba (Jujube).

Vegetable-gardening is conducted chiefly by the Chinese and Japanese, who grow most of the more easily managed vegetables. Nearly all the vegetables found in the mainland markets can be grown in Hawaii, but some require special skill and a few demand an elevated location. All the cucurbits are difficult of culture except in isolated localities because of the prevalence of the melon fly (*Dacus cucurbitæ*), which also attacks less seriously tomatoes, peppers, and a few other vegetables. Sweet corn, peppers, and tomatoes were shipped experimentally to San Francisco as winter vegetables and realized good prices, but it was necessary to discontinue this trade because the melon fly had been found to some degree in each of these vegetables and is not known in California. Sweet potatoes, which are so easily grown here, have been shipped to San Francisco during the spring and early summer months, and early onions, chiefly of the Bermuda type. Both of these bring high prices, being easily grown in good quality for the opportune season in the market, and each may become the basis of a rather important trade if no insect or disease prevents its being shipped.

Taro (*Colocasia antiquorum* var. *esculentum*) furnishes the chief food of the native Hawaiians and is much used by foreigners also. It, therefore, requires a considerable area of land to supply the local market. There are many varieties of taro and some of the best succeed only under submerged conditions and for this reason, this crop, with rice, occupies most of the valley bottoms, where water can be led readily from the streams. Other varieties which succeed with less water are grown in moist lands where there is a heavy rainfall. Very few Hawaiians now engage in growing taro extensively, the industry being conducted chiefly by the Chinese. The plant has a large corm or rootstock and is propagated by cuttings from the top of this or of the smaller offsets. The crop matures in ten to fifteen months and the corm which is rich in a very easily digestible starch, furnishes most of the food, although the tender young leaves are also eaten. Taro is eaten as a vegetable and makes a good substitute for the potato, but its chief use is in the making of poi, the most important Hawaiian dish, which is prepared by crushing the steamed corm with stone pounders or more recently by American-made machinery. It is about the consistency of paste and is eaten after it has been allowed to ferment for a few days. Taro flour under various trade names has been placed upon the American markets.

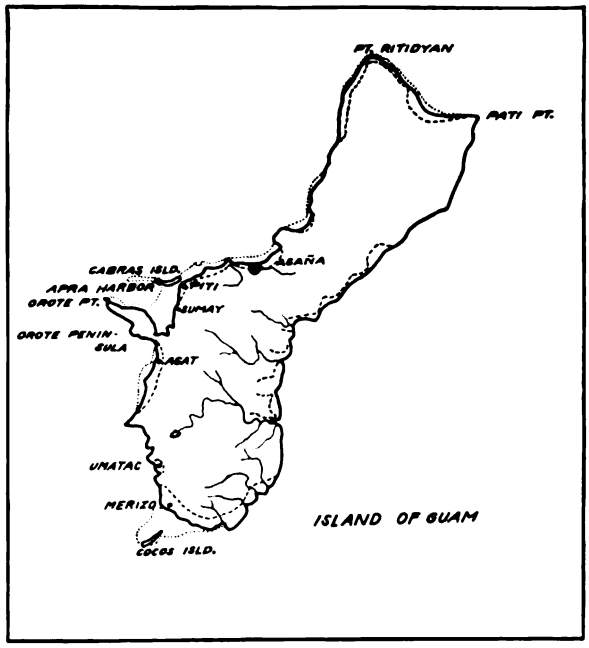
Hawaii is a land of flowers, but many of the most beautiful blooms are on large trees and vines. Among the most striking of these are the royal poinciana (*Poinciana regia*), golden showers (*Cassia fistula*), pink showers (*Cassia grandis*), pink and white showers (*Cassia nodosa*), bougainvillæa, petrea, beaumontia, alamanda, bignonia, and plumeria. The night-blooming cereus flourishes and presents a magnificent sight when in flower. The old Hawaiian custom of bedecking

guests at a feast or embarking friends at a departing vessel is still kept up, and it is one of the unique and beautiful scenes in Hawaii when a steamer engaged in the Honolulu-San Francisco run leaves the Hawaiian port, with all its passengers decorated with "leis" (pronounced lays) or wreaths of flowers. Until recent years, this constituted the chief market for cut-flowers. During the last eight or ten years a considerable cut-flower trade of the American type has grown up and there are several Americans now in the business and also a number of Japanese florists.

The city of Honolulu supports a number of small parks, containing some interesting and curious plants. In gardens, owned by private individuals, are many more rare and beautiful plants. The great Moanalua estate, the property of Samuel M. Damon, with its parks and gardens, is one of the most interesting places of Honolulu for the admirer of plants, and no plant-lover should pass by the islands without visiting these grounds, which are traversed by the public road and thus generously made available to all who are interested. Another strikingly beautiful sight which no one who is in Honolulu at the right time should fail to see, is the 1,000 feet or more of night-blooming cereus at the Oahu College grounds. The exact seasons of flowering are impossible to predict, but there is usually a grand display for several nights in May or June and again in August or September.

Literature.—The literature of horticulture in Hawaii is limited. The only book devoted exclusively to the subject is "Fruits of the Hawaiian Islands," by G. P. Wilder, Hawaiian Gazette Company, Ltd., Honolulu. The bulletins and reports of the horticultural department of the Hawaii Experiment Station cover a part of the field and are as follows: "The Banana in Hawaii," Bulletin No. 7; "Citrus Fruits in Hawaii," Bulletin No. 9; "The Mango in Hawaii," Bulletin No. 12; "Marketing Hawaiian Fruits," Bulletin No. 14; "Shield-budding the Mango," Bulletin No. 20; "The Avocado in Hawaii," Bulletin No. 25; "Fruit-marketing Investigations in 1907," Press Bulletin No. 21; "Pineapple Shipping Experiments in 1908," Press Bulletin, No. 22; "The Pineapple in Hawaii," Press Bulletin No. 36; Annual Reports 1901 to date. See also "Index to Publications of the Hawaii Agricultural Experiment Station, July 1, 1901 to December 31, 1911." Numerous references to horticultural subjects are to be found in "The Hawaiian Forester and Agriculturist," the "Paradise of the Pacific," "The Mid-Pacific Magazine," and other periodicals.

J. E. HIGGINS.



1988. The island of Guam.

Guam.

The island of Guam (Fig. 1988), belonging to the group of islands known as the Ladrones or Marianas, lies in the Pacific Ocean between the parallels 13° 14′ and 13° 40′ north of the equator, and between the meridians 144° 37′ and 144° 56′ east of Greenwich. A line drawn almost due west from Guam strikes, at a distance of about 1,200 miles, the San Bernardino Passage dividing the island of Samar from the southern extremity of Luzon and marks the relative position of Guam and the Philippine Archipelago. Of the fourteen islands composing the Mariana group, Guam is the largest and its position the most southerly. It is of historic interest as the first stopping place of Magellan after passing beyond the South American coast on that remarkable voyage of exploration for the Spanish crown in 1521. The island did not, however, assume a place of special interest in the minds of the American public until the year 1898 when, by the provisions of the treaty of Paris concluding peace between the United States and Spain, it became territory of the United States.

Guam has a warm and humid climate. The temperature is remarkably equable throughout the year; and no physical or other influences exist to cause perceptible variation in temperature in different parts of the island. Absolute temperatures seldom rise above 95° F. in the heat of the day or fall below 70° F. at night. The average annual rainfall is in the vicinity of 120 inches; and a very large percentage of the yearly precipitation occurs during the period from July to November inclusive. During the remainder of the year rainfall is erratic and uncertain. The climatic factor most potent in retarding horticultural progress is the occasional furious hurricanes or typhoons. These storms occur more or less frequently and sometimes with such sweeping force as to leave the island vegetation almost completely devastated of all its foliage.

The northern portion of the island is an inclined forest-covered plateau, rising from near sea-level at a point a short distance north of Agaña to an elevation of some 500 or 600 feet at the northern extremity of the island and to an almost equal elevation along the east coast. The soil of this plateau is of coral derivation and at many points is underlaid with partially disintegrated coral limestone covered at many points with but a few inches of soil. This territory is well drained and has a fertile soil usually well adapted to the cultivation of horticultural products. On it coffee grows luxuriantly and yields abundant crops of berries of a specially superior flavor. Cacao (*Theobroma Cacao*), producing the so-called chocolate bean of commerce, was grown in this district with much success prior to the severe typhoon that ruined the plantations in 1900. The lack of fresh water streams or other domestic water-supply prevents the rapid development of this district. The remaining portion of the island lying south of Agaña has a rolling contour and is traversed by numerous river valleys made fertile by sediment deposited from the surrounding hills. These valleys afford favorable conditions for the cultivation of coconuts and many of the tropical fruits. Constant and

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heavy rains during the period of excessive rainfall have leached the hill lands, rendering them of little value for horticultural purposes. The island's highest elevation is found in the peak "Humuyong Manglo," signifying "the mountain whence the winds issue." This peak is located in the southwestern part of the island and reaches an altitude of 1,274 feet. A strip of strand, varying in width but usually under a mile in extent, fringes a greater part of the coast-line. The soil of this low land has been formed partially from the washings and erosions from the surrounding hills and partially from shell, calcareous sands, and the like, of marine formation. Due to the fertility of this soil and to its proximity to the sea which furnishes fish and transportation facilities for the exchange of supplies between the different parts of the island, all the principal villages have been established here, and here also horticulture is more extensively practised than in any other part of the island.

The advantages of a well-defined economic system, involving the principles of labor-division as practised in modern enlightened communities, are unrecognized in Guam. In general, every man is his own fisherman, his own tradesman, and husbandman of the trees and plants required to feed his own family. The local market demands under such a system are decidedly limited; and the tendency is naturally in the direction of small plantings and indifference toward the improvement of varieties and methods of cultivation. There are neither nurseries nor seed farms on the island. Plants of the banana, pineapple, and the like, grow from suckers, but aside from those species which propagate naturally, the fruits trees are the simple result from chance seedlings voluntarily produced from discarded seed, with but little effort being made to foster or preserve them. The practice of perpetuating superior forms by the various methods of asexual propagation is unknown to the Guam planter.

Agricultural implements are of the crudest and most antiquated type. The native plow is an awkward home-made wooden contrivance with a single handle and a rough cast moldboard and point. It is drawn by a water buffalo and tears and thrusts aside the soil, leaving a ragged furrow about 4 inches wide. A man with a buffalo and one of these implements, working on an eight-hour-day basis, will require at least five days to plow in a most ineffectual manner 1 acre of land. In addition to the plow, a simple little hand tool, the fosiño, on the principle and of the construction of a scuffle-hoe, is the only implement in common use for tilling the soil.

Regardless, however, of the primitive methods of the people, Guam is essentially a land of agriculture. It has no other possible natural resource. With a moderately fertile soil and a climate permitting the planting and harvesting of crops during 365 days of the year, the island is a garden specially created for the farmer. How rapidly the development of the agricultural industries may come, or how remote the time when the full possibilities of the island may be achieved, is a matter of mere conjecture, but the absolute necessity of improvement is daily becoming more manifest. Education is rapidly creating a higher and more expensive standard of living and this increased expense must be balanced by correspondingly augmented production from the soil. Lack of shipping facilities has seriously impeded progress in horticultural lines and until improvement is brought about there is little to encourage the establishment of the fresh fruit industry upon a commercial basis. Products for export must necessarily be limited to such of the less perishable crops as coconuts, coffee, and cacao, and to articles preserved by some of the various methods, of which pickling, bottling, canning, and evaporation are examples.

The coconut (*Cocos nucifera*) was found growing in Guam at the time of the discovery by the Spaniards. Safford observes that "the first accurate description of the coconut was published by Dampier from observations made by him in Guam in 1686." This is the most important product of the island, copra, the dried kernel of the nut from which the coconut-oil of commerce is expressed, constituting the only article of export. The nut is also variously used in cookery, and furnishes one of the principal feeds for both poultry and hogs. Aside from the nut itself, the leaf is split through the midrib from the terminal end and the pinnæ of each plaited together, forming from each frond two crude but effective shingles for thatching the roofs of buildings. The fact that probably 95 per cent of the dwellings in Guam are thatched with this material indicates the extent to which the leaves are used for this purpose. Toddy, a popular beverage, non-intoxicating when first drawn, is collected from an incision in the flower-stalk; and this, by the process of boiling, is converted into syrup, and, by a further continuation of the process, sugar is obtained. Fermented toddy is an intoxicant and is extensively employed in lieu of yeast in making bread. It is also used in the preparation of vinegar or, by distillation, a highly alcoholic liquor, known as "aguardiente," is produced.

The native devotes but little attention to his trees; yet natural conditions are favorable, and the trees flourish and yield good crops regardless of neglect. Bud-rot has not made its appearance on the island. Cattle running at large cropping off the young trees, and rats which gnaw off the young immature nuts, are, as a matter of fact, the only serious enemies of the plantation. In Guam, crops are gathered to a limited extent during all seasons of the year, but the general tendency is to confine pickings as much as possible to the dry season, when weather conditions facilitating the process of air-drying the copra usually prevail. Drying with artificial heat is never practised. That part of the output going to the export trade is disposed of to Japanese traders who ship by sailing schooners to Yokohama where the oil is expressed and the residual meal employed to increase fertility of Japanese gardens. To give some idea of the importance of the industry, the following custom-house records covering the exports for the annual periods ending June 30, for the past three years are given:

Period	Tons	Value
1909–10	534.5	$33,610.11
1910–11	870.5	51,058.80
1911–12	1047.0	59,924.10

Fruit of bananas and plantains, Musa species, grow in rich profusion everywhere and form an important food staple of the people. Plantations are not established systematically and are confined to small areas of land contiguous to the home. Total neglect of the plantation is common and when cultivation is at all practised it consists of the occasional removal of weeds and grasses and the application of this organic matter and a small amount of surface soil about the base of the plants. This mulch of soil and litter serves two purposes, according to the season of its application. In hot dry weather it cools the soil and assists in the conservation of moisture, and in the season of heavy rainfall its rapid decomposition adds fertility to the root-feeding areas of the soil.

Among the forms common in Guam, the Chinese dwarf or Cavendish banana (*Musa Cavendishii*), known in the vernacular of Guam as chotda Guahu (the Oahu banana), is the only well-known commercial variety. It is of comparatively recent introduction and is not well distributed. Chotda Dedos (the finger banana) is so named from the long slender form of the fruit, lending a fancied resemblance to the fingers on a human hand. Chotda Haya (pronounced hadya—signifying native or unintroduced banana) is supposed

to have been the earliest form cultivated on the island. Chotda Dama is similar and possibly identical to the variety "Gloria" of the Philippines, which Blanco refers to *M. paradisiaca ternatensis*. Chotda Manila (*M. paradisiaca cinerea*) has been introduced from the Philippines, where it is known as Letondal or Latendan. This variety, though inferior in flavor and subject to cracking and dropping from the bunch when ripe, is a heavy-yielding sort and consequently a most popular one. Probably 75 per cent of the bananas annually produced on the island are of this variety. Chotda tanduque (*M. paradisiaca magna*), a favorite fruit of the plantain type, eaten both cooked and uncooked, is also of Philippine introduction. Other good varieties of recent introduction which may be expected to assume leading places in the future are, the Bungulan (*M. paradisiaca suaveolens*), the Lacatan (*M. paradisiaca lacatan*), from the Philippines, and the Brazilian banana from the Hawaiian Islands. The Jamaica or Bluefields banana was introduced into Guam during the fiscal year 1912 by the United States Department of Agriculture.

1989. A native hut in Guam; roof thatched with coconut leaves. Sour-sop (Annona muricata) in left foreground

The leaves and false stem of the banana are relished by cattle and after maturing their fruit these constitute a valuable by-product.

Breadfruit (*Artocarpus incisa*) grows in great luxuriance in the warm humid climate of Guam, and it is probably nowhere more abundant or more highly esteemed. Uncultivated and uncared for, the copious supply of nutritious food which it yields during its long fruiting season from June to December is wholly a gift of Nature. Both the seed-bearing variety and the more highly improved seedless form of *A. incisa* exist in extensive forests. The breadfruit is not a commercial article, yet the important part which it plays in the domestic economy of the people renders it worthy of mention in a work of this character. In addition to the value of the fruit for human food, the immature fruits are fed to cattle and hogs and the ripe fruit also constitutes a most valuable hog-feed. The leaves of the breadfruit tree are largely employed as a fodder for cattle and the fondness shown for them by the native cattle is not acquired; for cows imported from the United States manifest an equal relish for them at the first feeding. In this connection the necessity of providing the young plants with protection from cattle is indicated.

The coffee shrub (*Coffea arabica*), and to a more limited extent the Liberian species (*C. liberica*), are successfully grown, and especially is this true in the district of Yigo in the northern part of the island and at Sinahaña situated on an elevation south of Agana. It is said that during the latter part of the Spanish régime when direct shipping means existed between Guam and Manila, an export trade of considerable importance was enjoyed and that the Guam product was recognized for its superior quality. Coffee is now more sparingly grown than in former times and within the past few years the output has not been sufficient to supply the home demand. The absence from Guam of the coffee fungus, *Hemileia vastatrix*, so widely distributed throughout the Old World Tropics and so destructive to the coffee industry wherever it exists is both interesting and significant. Aside from field-rats, which feed upon the sweet pulp, dropping the naked berry to the ground, there are no serious pests to contend with in Guam. Even with the limited acreage adaptable to coffee-culture, the industry is entirely capable of development to the extent of not only supplying the home demand but also of furnishing a considerable surplus for export.

The mango (*Mangifera indica*), a most delicious tropical fruit, is grown in Guam in two races, both of which come true to seed, or at least practically so, and are propagated only by that method. The "Guam mango" is of medium size, contains but little fiber and is free from the disagreeable taste of turpentine, common to some of the inferior varieties, when it is properly ripened. It is identical with the common "Carabao" mango of the Philippines. In the quality of its fruit this variety is superior, but on the island of Guam it possesses the disadvantages of light and irregular bearing-habits. Another feature in the cultivation of this species that tends to discourage planting is the fact that trees require from twelve to twenty years to grow from the seed to a state of production. Owing to these habits of slow development and light yields, the supply of mangoes is insufficient to meet the demand for them and the same conditions create an ever-ready market-price of 5 to 10 cents United States currency for a fruit. Large trees claimed to be more than 100 years old, measuring as much as 9 feet in circumference of the trunk and from 50 to 60 feet in top diameter, are common.

The "Saipan mango" introduced from the island of that name, now seat of the German government in the Marianas, is a small fruit weighing about four ounces. It is full of a coarse fiber and is inferior in flavor. The tree of this variety is of comparatively small dimensions, comes into bearing in four to seven years from the seed, and is a regular and heavy bearer. As a fruit this race is of little importance, but as a stock upon which to inarch the "Guam mango" it should prove valuable, as its less vigorous root-system should result in dwarfing the tree of the Guam variety and in rendering it more prolific.

In addition to the more important fruits noted above, others of more or less value abound in great variety. Lemons and limes of fair quality and oranges of an inferior grade are plentiful. The bullock's-heart (*Annona reticulata*) grows spontaneously, and the sour-sop (*A. muricata*) and sweet-sop (*A. squamosa*) are common fruits. The papaya (*Carica Papaya*), in a degenerate form, has escaped from cultivation and grows in great profusion throughout the island. Excellent papayas are grown from introduced seed of improved forms, but hybridization between these and the native papayas results in a reduction in the size of the fruit with each successive generation. When

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careful methods of hand pollination are not practised, the use of introduced seeds of the best improved varieties is found essential to best results. The avocado (*Persea gratissima*) has been introduced since the establishment of American government on the island and the remarkable vigor and heavy yields of a few trees indicate a bright future for this new fruit. Pineapples, small in size and of fair quality, are found in neglected plantings. The United States Department of Agriculture has introduced plants of the Smooth Cayenne pineapple, which promises great improvement over the native variety. The sapodilla (*Achras Sapota*), the cashew (*Anacardium occidentale*), the carambola (*Averrhoa Carambola*), the Otaheite apple (*Eugenia malaccensis*), the guava (*Psidium Guajava*), and the tamarind (*Tamarindus indica*), are all listed in the catalogue of island fruits.

A discussion on vegetable-gardening in Guam must essentially treat of possibilities rather than of achievements. Gardening is practised to a very limited extent and in accordance with the most antiquated methods. Among the most common temperate-zone vegetables, tomatoes, potatoes, cabbage, sweet corn, and garden peas are not successful. Beans in wide variety of types, radishes, lettuce, okra, eggplants, peppers, cucumbers, muskmelons, and watermelons are all successfully produced. Important rootcrops, handled more as field than garden products, are yams, taro, and sweet potatoes. The most important food staple cultivated on the island is maize. Rice was formerly grown extensively, but now nearly all the rice consumed on the island is imported. Tobacco is also successfully cultivated by the natives. Peanuts are common and are grown entirely from vine cuttings. The difficulty of preserving the vitality of many of the common garden seeds in the warm humid climate of Guam is one of the principal causes of the present indifferent attitude shown by the native farmer toward the cultivation of the vegetable-garden.

A few species of valuable tropical hardwoods are found in the forests of Guam but owing to extravagant and wasteful cuttings, the better grades of timber are becoming comparatively scarce. Among the most important of these species, *Afzelia bijuga*, known in Guam as "ifit," is extensively used for general construction purposes and as a cabinet-wood. *Calophyllum inophyllum*, generally designated as "palo maria," is usually employed in cabinet-work and the construction of cart wheels. *Claoxylon marianum*, the "panao" of the Chamorro, is specially valued for flooring purposes. *Heritiera littoralis*, called "ufa," is utilized in making plow-beams, while *Ochrocarpos obovalis* and *Premna Gaudichaudii*, known respectively as "chopag" and "ahgao" are extensively employed in the construction of buildings.

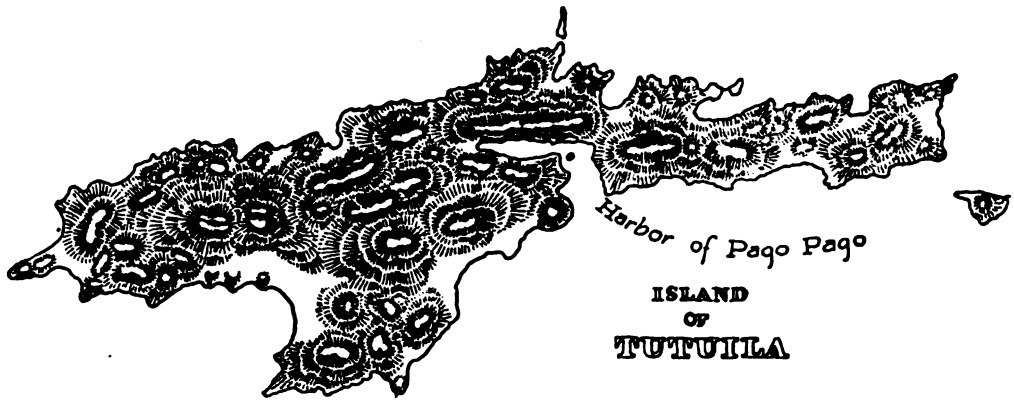
A systematic flora of the island has recently been published by E. D. Merrill ("An Enumeration of the Plants of Guam," Philippine Journ. Science, Vol. IX, 1914). Merrill points out the affinity of the Guam flora with that of the Malayan region, practically all the indigenous genera being of wide Indo-Malayan distribution. The nearest approach to an endemic genus is Saffordiella, which also is found on the island of Yap. Among the new orchids described by Ames are species of Bulbophyllum, Liparis, Eulophia, Phrætia, Cœlogyne, Saccolobium, and Dendrobium. Among the conspicuous forest trees, Merrill describes several banyans, the sacred nunus of the natives, *Ficus mariannensis* and *F. Saffordii;* the yoga, *Elæocarpus joga*, a lofty tree with buttressed trunk and clusters of bluish grape-like fruit; a new almendra, or talisai, *Terminalia Saffordii*, with edible almond-like fruit; and several species of Eugenia. He also describes several new shrubs, among them, *Macaranga Thompsonii* and *Phyllanthus Saffordii*, belonging to the Euphorbiaceæ; *Grewia mariannensis*, closely allied to the Polynesian *G. malococca;* a number of Rubiaceæ, including species of Hedyotis, Morinda, Oldenlandia, Psychotria, and Tarenna; and *Discocalyx megacarpa*, a plant with erect habit, glossy green leaves, and bright red berries.

For further information on the horticulture of Guam, see "The Useful Plants of Guam," by Safford, and the Annual Reports of the Guam Agricultural Experiment Station.

J. B. THOMPSON.

Tutuila.

The most important island of American Samoa (Fig. 1990) is situated about 4,200 miles southwest of San Francisco in latitude 14° 20′ south and longitude about 170° 40′ west of Greenwich. Although smaller than the German islands, Savaii and Upolu, lying to the westward, it is more important strategically on account of its remarkable natural land-locked harbor, Pago-Pago, the precipitous walls of which afford safety to an entire squadron even during the violent hurricanes which sometimes sweep the group. Tutuila has an area of about 54 square miles, with a population of nearly 4,000 inhabitants. Like other islands of the group, it is volcanic with barrier coral reefs surrounding it. The forest-clad mountains rise to a height of about 3,000 feet. Several other neighboring islands belonging to the United States have a combined area of not more than 25 square miles and a population of 2,000 inhabitants. The group known as Manua, lying a degree to the eastward of Tutuila, is composed of the small islands Tau, Ofu, and Olosenga, the first formed like a great mole-hill, the other two rising precipitously from the sea. Rose Island, lying 70 miles to the eastward, is a typical coral atoll almost circular in shape.



1990. Tutuila.

The islands are swept almost continually by the

trade-winds, and there is abundant rainfall. The climate is healthful, the volcanic soil quickly arbsorbing the precipitated moisture. December, the warmest month, has a mean temperature of about 87° F.; July, the coolest month, a mean temperature of about 78° F.

American Samoa is governed by an officer of the United States Navy, detailed by the Secretary of the Navy. The wisdom of the government in dealing with the natives is shown by its methods of administration. Ancient Samoan customs are followed as closely as possible. The villages choose their own chiefs from those who have hereditary rights to the position, subject to the governor's approval. The villages are grouped into counties ruled by high chiefs and the counties are grouped into three great districts, Eastern Tutuila, Western Tutuila, and the District of Manu'a, each of which has at its head a chief appointed by the governor. The customs officer is a naval officer and the health department is under a medical officer of the Navy, who has charge of the island dispensary and the hospital, or sick quarters, of the station. At the end of each year there is held a general fono, or assembly to which all parts of the islands send delegates. In this assembly matters of general interest are discussed, new laws recommended, complaints and suggestions are listened to, laws are explained, and information given regarding all matters affecting the welfare of the natives and the administration. Suffrage is restricted to the heads of families (matais) in accordance with Samoan custom, the family and not the individual being considered the unit of society.

1991. Samoan dwelling thatched with sugar-cane leaves, with side blinds of coconut-leaf mats, on the sloping shore of Pago-Pago Bay, Island of Tutuila. Surrounding vegetation: bananas, coconut palms, breadfruit tree, and 'ava pepper (Piper methysticum), a large mango tree in the distance.

There are no public lands in American Samoa. Even the land occupied by the Naval Station was acquired from the native owners by purchase. A few small tracts are owned by foreigners, who acquired their titles before the American occupation. Only one plantation is owned by a white man, and he is connected by marriage with one of the highest chiefs of Samoa. On his plantation in a valley on the north side of Tutuila, he has planted coconut trees, rubber, cacao, and a small amount of coffee. On account of the small amount of arable land there is no opportunity for Americans to become planters in these islands.

The only product of commercial importance is copra, the dried meat of the coconut. All the beaches are fringed with coconut palms. At the mouths of streams where the water is brackish, there are mangrove thickets composed chiefly of Rhizophora and Bruguiera. Surrounding the thatched huts of the natives are many ornamental plants, including *Hibiscus rosa-sinensis*, the beloved aute of the natives, who adorn themselves with its bright red flowers; trees of the fragrant *Canangium odoratum*, here called "moso'oi," from the flowers of which the natives make garlands and prepare a scented oil for anointing their bodies; clumps of pandanus, from the leaves of which they weave their mats; ironwood (*Casuarina equisetifolia*) called "toa," from the trunks of which they make spears and war-clubs; *Piper methysticum* from the roots of which they prepare their national drink called "'ava;" and near-by are usually clumps of bananas and plantains; patches of taro (*Colocasia antiquorum* var. *esculenta*) the starchy roots of which form one of their most important food staples; trees of breadfruit (*Artocarpus incisa*) magnificent mango trees; the Polynesian "chestnut" (*Inocarpus edulis*), called "ifi;" several varieties of yams (Dioscoreæ) the paper mulberry (*Broussonetia papyrifera*), from the inner bark of which the women make bark-cloth, the widely spread *Hibiscus tiliaceus*, here called "fau," from the bark of which they make cordage; urticaceous plants, fausonga (*Pipturus argenteus*) and fau-pata (*Cyphophus macrocephalus*), from the fiber of which they make their shaggy mats and their fishing nets; dracæna-like *Cordyline terminalis*, here called "ti," from the leaves of which they make skirts worn while fishing on the reef; besides many other interesting and useful plants.

Though much of the island is too steep for cultivation, every foot of the soil near the coast seems to yield useful plant products, and edible sea-weeds are secured from the shallow lagoons between the shore and the surrounding reefs.

The slopes of the mountains as well as the valleys are covered with rich humus formed principally by the decay of vegetable matter together with a slight proportion of decomposed volcanic rock. Nearly all tropical plants which have been tried have been grown successfully. Oranges, grapefruit, lemons, limes, citrons, the mango, alligator pear (aguacate, or avocado), papaya, pineapple, are among the introduced fruits. The citrous fruits are subject to scale. The lemons are mostly thick-skinned and of inferior quality. Bananas of many varieties are cultivated, each family having a banana-patch for its own use. Certain varieties are allowed to ripen and eaten raw, while others are gathered immature, before the starch has turned to sugar, and are cooked as a vegetable. The varieties growing in Samoa before its discovery are known as "fa'i Samoa," while those introduced by the whites are called "fa'i papalangi." Banana leaves are used for table-cloths, umbrellas, wrapping-paper (with the mid-rib removed), improvised hats (when it rains), and, when dried, for cigarette wrappers. In addition to the cultivated species there is a wild banana in the mountains, called "soa'a" (*Musa Fehi*, Bart.), which yields a black dye. Of this species which bears its fruit in an erect raceme, the natives have a story telling of a battle between the soa'a and the fa'i. The soa'a was victorious and ever since it has kept its head erect, while the conquered fa'i is compelled to bow its head earthward as a token of its humiliation.

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Several varieties of taro (*Colocasia antiquorum* var. *esculenta*) are cultivated, some of them in marshy places, others in clearings made in the forest. On the island of Tutuila there is not much marsh taro in comparison with upland taro. The latter is usually planted in virgin soil in holes made by a digging-stick. Very little care is afterward bestowed upon it except to keep the patches weeded. Marsh taro requires a constant supply of fresh water. The starchy roots must be thoroughly baked to destroy their acridity, which, like that of our Indian turnip, is caused by minute needles of oxalate of calcium (raphides). Closely allied to the taro is the giant taro, *Alocasia macrorhiza*, called "ta' amu" by the Samoans. Several kinds of ta'amu occur in Samoa, all of which are probably varieties of *A. macrorhiza*. They are propagated like upland taro. The roots, which sometimes reach a great size, in times of scarcity are an important food staple. The enormous satiny leaves are used for covering the native ovens. The young leaves of taro are cooked in various ways as a vegetable. One of the most agreeable dishes, called "palusami," is composed of the expressed cream of grated coconut meat combined with young taro leaves and a little salt water wrapped in an outer covering of leaves and baked in a native oven. The fermented paste made from taro known in the Hawaiian Islands as "poi" is unknown in Samoa.

Yams (*Dioscorea Batatas*), called "ufi" by the Samoans, resemble the forms known on the island of Guam as "dago." The tubers often grow to an enormous size. The plants are propagated by cuttings, each of which must possess an eye or bud from which the new plant springs. The plantations are made in clearings in the woods, stones are laid around the young plants and stakes are placed for the plants to climb upon. In about six months after planting the tubers are ready for food. As the propagation and gathering of yams are more difficult than in the case of taro, they are not so extensively grown, though they thrive well and are well liked by the natives.

Tacca pinnatifida, Forst., called "masoa" by the Samoans and commonly known as "Polynesian arrow-root," yields an excellent starch, which is used principally for pasting together the filmy beaten bast of the paper mulberry in making bark-cloth (siapo). It is also an article of food and is sometimes prepared with coconut custard in the form of dumplings or puddings. In Tahiti the natives braid beautiful hats from the epidermis of the flower-scapes and petioles of this plant. As with the yams, the tubers are mature when the plants die down. When fresh they are bitter. The starch is prepared by grating the tubers to a fine pulp which is put into a vessel of water. This becomes milky and the solid particles are removed by straining. After standing for some time, the starch settles and the clear liquid is poured off. This plant grows spontaneously in Samoa, but it is sometimes cultivated.

Rice is not cultivated. Though it was introduced into the island of Guam before the discovery of that island by Europeans, it was entirely unknown to the ancient Polynesians of the central and eastern Pacific.

The breadfruit (*Artocarpus incisa*) is planted about every village. It grows in the form of a symmetrical tree with spreading top. Its curved limbs furnish the Samoans with rafters for the roofs of their best houses; the viscid milky latex is used by them for many purposes; and the large lobed leaves are eaten with relish by all herbivorous animals. The fruit, gathered before it is quite ripe, is prepared for food in a variety of ways. It is often eaten with pork, fish, or fowl, sometimes with a sauce of cooked custard expressed from grated coconut meat; or in the form of dumplings cooked in this custard. As the breadfruit season is limited, quantities of the fruit are placed in pits and allowed to ferment, somewhat after the manner of sauer-kraut. Though the fermented substance has a very offensive smell, it is nutritious, and is made into cakes and baked. "Masi," the name of these cakes, is now a general term applied to all kinds of biscuits and crackers. The trees are propagated from suckers, to which a portion of a root of the parent plant is left attached. The young trees grow rapidly and in three or four years bear fruit.

The Polynesian "chestnut" (*Inocarpus edulis*) is a magnificent forest tree belonging to the Leguminosæ. Its fruit roasted in the shell has somewhat the taste of chestnuts and is much eaten by the Samoans. Its wood is hard and durable, of fine texture and very tough. It has the remarkable quality of burning readily while green.

Sugar-cane is grown to some extent. It has been grown by the Samoans from prehistoric times, but not for commercial purposes. No sugar is made on the island. The cane is relished especially by the children, who suck its sweet juice. Its principal use is in furnishing an excellent durable thatch for the houses of the natives.

Tobacco is grown in small quantities very much after the fashion pursued in other countries, first in seed-beds, then transplanted. It is consumed by the natives, both male and female, in the form of cigarettes wrapped with dry banana leaves.

Piper methysticum, called "kava" in some parts of Polynesia and "'ava" in Samoa, is extensively grown for the sake of the narcotic infusion prepared from its root. This is prepared with great ceremony in the presence of the chief or head of a family by young girls. In former times, the root was first chewed and then placed in the wooden bowl in the form of quids upon which cold water was poured from a coconut water-bottle; but now the root is rasped on an improvised grater made by puncturing holes in a sheet of tin. The infusion is not allowed to ferment but is drunk fresh, each person present partaking of it in succession in the order of his rank. 'Ava-drinking in Samoa is never indulged in so extensively as to become a vice, but the beverage is a wholesome and refreshing stimulant. 'Ava takes the place in Samoa of the betel pepper (*Piper Betel*) of the Philippines and the island of Guam, the leaves of which are chewed with areca nut and a little lime. The latter has never found its way into eastern Polynesia.

In the woods there are valuable hardwood trees, many of which are clothed with epiphytal orchids, lycopods, and ferns, and the slopes of the mountains yield rich returns to the botanist in rare ferns and other plants, especially graceful tree-ferns.

In the vicinity of Pago-Pago the most common trees are the fau (*Hibiscus tiliaceus*); milo (*Thespesia populnea*); lama, or candle-nut (*Aleurites moluccana*) called "kukui" in the Hawaiian Islands; toi (*Alphitonia excelsa*); tavai (*Rhus simarubæfolia*); masame (*Antidesma sphærocarpum*); tamanu, a species of Maba; and fetau (*Calophyllum inophyllum*). The futu (*Barringtonia speciosa*), a beautiful tree with glossy leaves and white flowers with crimson stamens, bears a peculiar four-angled fruit which is used in Samoa, as in Guam, for stupefying fish in tide pools on the coral reefs. The appearance of the red blossoms (aloalo) of the ngatæ (*Erythrina indica*) marks an epoch in the Samoan calendar. The ifilele, which is identical with the valuable ipil of Guam (*Intsia bijuga*), is prized for its durable hard wood, and is much used for house posts. The fragrant flowers of the langaali (*Aglaia edulis*), like those of *Canangium odoratum*, are used to scent the coconut-oil with which the natives anoint themselves. The fruit of the vi (*Spondias dulcis*) is highly prized by the natives and that of the nonu-fiafia (*Eugenia malaccensis*) is also eaten. The giant banyans (Ficus sp.), rising like great hillocks above the general level of the forests and remarkable for their numerous aërial prop-like roots, are regarded by the Samoans to be the dwellings of spirits (*aitu*). The Samoans have legends and songs regarding many of their forest trees and

shrubs, one of which called "The Battle between the Trees and Stones" is translated by Augustin Kraemer in his monumental work, "Die Samoa-Inseln" (Vol. I, p. 361, 1902), to which the reader is referred. See also "American Samoa," a general report by Governor W. M. Crose, dated June 22, 1912, Washington 1913; and F. Reinecke's "Flora der Samoa-Inseln," Engl. Bot. Jahrb., Vols. 23 and 25, 1897, 1898.

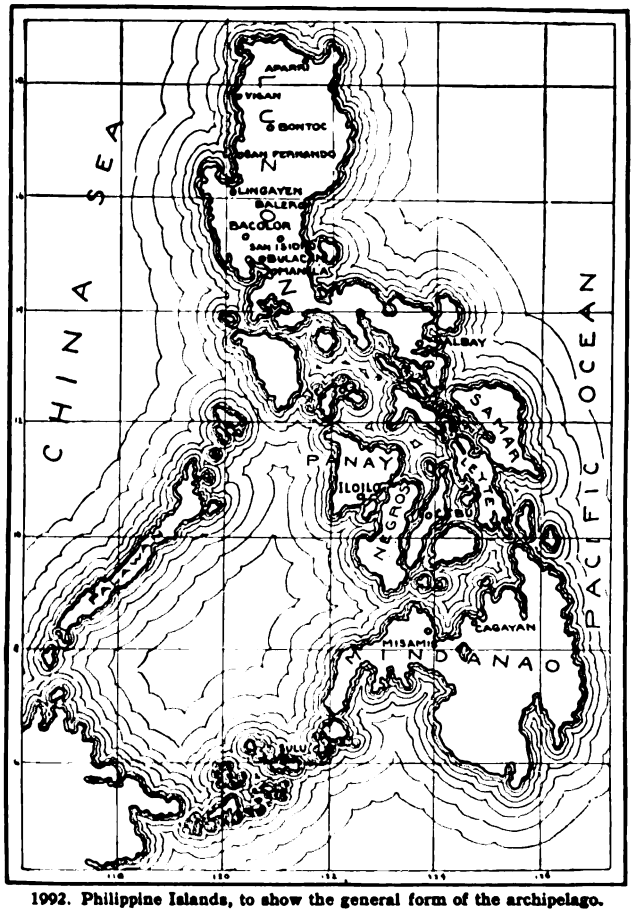
W. E. Safford.

Philippine Islands.

The Philippines (Fig. 1992), lying between the Pacific and the China Sea, extend almost due north and south from Formosa to Borneo and the Moluccas, and cover about 700 miles of longitude and 1,000 miles of latitude (from 4.40° to 20° north latitude, and 116.40° to 126.30° east longitude). The archipelago comprises 3,141 islands, having a total area of 127,853 square miles, and has a population of above 8,000,000 inhabitants. The largest islands are Luzon, with an area of 40,969 and Mindanao with 36,292 square miles.

The Philippines are of volcanic origin and in consequence the topography of the archipelago is characterized by a broken surface and more or less rugged mountains in all islands of any importance. Between the mountain ranges and on the banks of some of the largest rivers lie several rich, level valleys awaiting the advent of the cultivator, areas which are eminently suited for the cultivation of rice, corn, sugar, tobacco, hemp, and coconuts. The principal plains are found in Isabela and Cagayan Provinces, watered by the Cagayan River; in Tarlac and Pangasinan, watered by the Agno; and in Nueva Ecija and Pampanga, through which flows the Pampanga. The Cottabato Valley in the Moro Province is irrigated by the Mindanao River. The interior of Mindanao, from the mountain ranges east of the Agusan River to Lake Lanao in the west, consists of a remarkable series of level tablelands of great fertility between the mountains and cañons at an elevation ranging from 1,000 to here and there exceeding 2,500 feet.

The climate is remarkably mild and free from extremes, though there is considerable variation in temperature due to altitude. The Weather Bureau of the Philippines distinguishes three types of climate peculiar to the Philippines: (1) That of Sorsogon, Albay, Ambos Camarines, Catanduanes, and adjacent islands, the eastern coast of Luzon from the seashore to the mountains in Tayabas, eastern Isabela, and Cagayan, the north and east coast of Samar, the east and north coast of Mindanao and adjacent islands, the valley of the Agusan River, and the east coast of Leyte; this climate is characterized by an average rainfall of 3,090 millimeters, well distributed throughout the year, mean temperature 79.8° F., lowest recorded temperature, 62.4° F., highest 110.3° F., the greatest rainfall being in December, and the least in May, June, and July. (2) That of the provinces of Batangas, Bataan, Ilocos Norte, Ilocos Sur, Zambales, Union, Rizal, Western Bulacan, Pampanga, Nueva Ecija, Tarlac, Pangasinan, the west coast of Panay, Mindoro and Mindanao, with an average rainfall of 2,120 millimeters, falling mainly from May to October with a distinctly dry season during December, January, February, March and April; mean temperature 80.5° F., highest recorded temperature 103.1° F., lowest 57.7° F. (3) That of the extreme north of Luzon, including the Cagayan Valley and the Batanes Islands, the shores of Laguna de Bay, the west coasts of Samar, and Leyte, the north and east coasts of Panay, Negros, Cebu and Bohol, Davao Gulf and the south end of the Zamboanga Peninsula; annual rainfall 1,882 millimeters, falling mainly from September to January, with a short dry season in February, March, and April, mean temperature 79.7° F., highest recorded temperature 100° F., lowest, 59.9° F.



1992. Philippine Islands, to show the general form of the archipelago.

The following export statistics for the years 1897 and 1911 illustrate the development of the plant industries in the Philippines during the last fourteen years:

1897

Manila hemp	$8,571,850
Sugar	6,911,535
Copra and coconuts	2,687,978
Tobacco products	2,128,380
Indigo	72,379
Coffee	45,648
Candlenut products	35,219
Ilang-ilang oil	24,937
Sappan wood	23,323
Copal	22,562
Maguey fiber	13,687
Fruits	8,393

1911

Manila hemp	$16,141,340
Copra	9,899,457
Sugar	8,014,360
Tobacco products	3,605,567
Bamboo hats	301,141
Maguey fiber	254,053
Copal	49,716
Ilang-ilang oil	47,404
Gutta-percha	41,065
Fruits and nuts	23,568
Sappan wood	16,220
Kapok cotton	11,324
Coffee	366
Cacao	199

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By comparing these statistics it will be seen that the exportation of hemp has about doubled during this period; copra has leaped into second place instead of sugar, of which there has been a comparatively small increase; the production of maguey fiber has increased over twenty-fold.

Rice, of which there are about 1,000 varieties more or less, is the most important cereal in the Philippines. The principal rice-producing provinces are, in the order of their importance, Pangasinan, Nueva Ecija, Tarlac, Ilocos Norte, Bulacan, Pampanga, and Capiz.

Corn succeeds well, but is of comparatively limited cultivation, Cebu and Pangasinan being the chief producers; however, corn-growing is greatly on the increase. Mungos and cowpeas are the only legumes grown under field-culture, but are not cultivated extensively.

Manila hemp is the leading export article; it is obtained from the leaf-stems or petioles of the abacá (*Musa textilis*), and is grown principally in Albay, Leyte, Ambos Camarines, Sorsogon and Samar.

Copra is the next important export. Tayabas, Laguna, Albay, Samar, Moro, Cebu, Capiz, and Leyte are the source of most of the copra, and the culture of the coconut is on a steady increase.

Sugar, the fourth most important crop, is cultivated primarily in the Provinces of Occidental Negros, Pampanga, Batangas, and Iloilo.

Most of the tobacco is grown in Isabela, Cagayan, Cebu, La Union and Pangasinan.

The statistics below relate to the six principal crops of the Philippines for the fiscal year 1911.

Crop	Area Hectares	Product	Amount produced	Approximate total value in provincial markets
Rice.....	1,043,757	Cleaned rice	574,842,682 kilos	$32,995,940
Abaca.....	404,160	Manila hemp	171,879,598 kilos	13,750,367
Coconuts.....	208,476	.....	.....	.....
Average of 200 trees per hectare	.....	Ripe nuts for food	154,980,726 nuts	13,130,636
		Copra	118,323,114 kilos	
		Coconut oil	6,602,966 liters	
		Palm wine	37,649,880 liters	
Sugar-cane.....	120,313	Crude sugar	243,924,574 kilos	12,196,238
Corn.....	302,516	Shelled corn	186,404,700 liters	4,361,869
Tobacco.....	69,015	Leaf tobacco	25,518,132 kilos	3,444,947

Both fruit- and vegetable-culture have been greatly neglected in the Philippines, notwithstanding the fact that the soil is almost everywhere of great fertility and that a great number of vegetables succeed well and produce abundantly when properly cared for.

Coconuts, with the steady and increasing demand for copra and other coconut products, are undoubtedly destined to become not only the chief horticultural industry in the Philippines but the leading industry in the archipelago. If a coconut plantation is well located and intelligently cared for there is probably no other enterprise in the Philippines today that offers so large a return with so little care and expenditure. (See Philippine Bureau of Agriculture, Bulletin No. 17.)

Coffee (*Coffea arabica*) was a very profitable crop until the entrance of the coffee blight (*Hemileia vastatrix*) about twenty-five years ago, which gradually destroyed the hitherto very profitable coffee-plantations. Coffee-culture is now of little or no importance, and coffee to the value of $255,039 was imported in the fiscal year ending 1911. *Coffea liberica*, *C. robusta*, and the Maragogipe hybrid have been introduced in order to revive the coffee industry, but without avail. From the present outlook, coffee-growing will never become an important industry until a blight-resistant variety shall have been found that is equal in quality to the Arabian coffee.

The cacao (*Theobroma Cacao*) was long ago introduced into the Philippines, and large areas are well adapted to the culture of this tree, particularly in Mindanao, but although found in all provinces, even the home demand for cacao has never been supplied, and the cacao products imported into the Philippines in 1911 amounted to $261,935. The reasons for this neglect of what would undoubtedly be a profitable industry are that hemp, coconuts and sugar-cane, which require less attention and care, yet yield profitable returns, have been more than the cacao adapted to the agricultural educational standard so far attained by the population in the Philippines. It should not be forgotton, however, that systematic cacao-culture has never been introduced, either by the Spaniards, or by the Americans after their occupation of the archipelago. It cannot be doubted but that cacao will some day become one of the most important of the Philippine agri-horticultural exports.

Fruit-growing, in the pomological sense of the word, is scarcely even in its infancy. Fruits, fresh, canned and dried, were imported to the value of $241,686 in 1911, while the total horticultural exports for the same year were but $24,053. It is thus seen that the foreign markets are all neglected, and yet there is no doubt but that Hongkong could readily absorb many times the amount of fruit that is sent there and that much could be exported to Japan, China and Cochin-China, and even Australia. This latter country imported in 1910 citrous fruits alone to the value of $107,445 from California and the Mediterranean countries, and, in fact, the Philippines themselves, the home of some of the citrous fruits, yearly import oranges, pomelos and lemons that are far inferior to the home-grown product; canned pineapples are imported from Singapore and Hawaii. However, there has been an awakening during the past year to the anomaly of this situation, and considerable attention is beginning to be paid to the fruit industry.

Owing to the long distance to the principal large foreign markets, and the perishable nature of most of the fruits cultivated, the Philippine Islands can hope to export but few fresh fruits, such as mandarins, oranges, pomelos, bananas and mangoes, and while the production of fresh fruit for export should become a considerable item, the manufactured products—fruit canned, dried, crushed and grated, made into jams, jellies, marmalade, fruit syrups, flavoring extract and wine—are destined to be of primary importance. In this form the Philippine fruits can compete with others for the world's markets.

Two fruits only, the banana and the mandarin, can be said to be systematically planted and cultivated, and even then the care they receive is primitive. Practically all the mandarins are grown in a small district in Batangas; budding and grafting is never practised; marcottage is sometimes employed in the propagation of particularly choice fruit trees, principally the chico. Even the mango, the most famous of the Philippine fruits, is grown on the edges of the rice-paddies, on hillsides and along the roads, instead of in regularly planted orchards.

Also, there are many districts in the Philippines in which such hardy and vigorous species as the mango, tamarind, chico, and breadfruit have not yet been introduced and there are others such as the bauno (*Mangifera verticillata*), marang (*Artocarpus odoratissima*), and kambog (*Dillenia speciosa*), which are unknown except in their native habitat.

The banana (*Musa sapientum*, *M. paradisiaca*, and *M. humilis*) is the most important of the Philippine fruits as a food; the flower-buds are eaten as a vege-

table. There are probably over one hundred varieties of bananas in the Philippines, of which the following are the most important in order of their enumeration: Lacatán, Latundán, Sabá, Gloria, Bungulan, Daliring señora, Butuan, Matabia, Lacatán morado, Ni-lanzon, Tundoc. These varieties occur under many synonyms.

Next to the banana, the papaya (*Carica Papaya*), is the most generally grown fruit in the Philippines; a very good variety of this fruit is being gradually disseminated. The second most important fruit commercially is the mandarin (*Citrus nobilis*), which has already been referred to. The trees are all seedlings, but the fruit is nevertheless remarkably good and uniform in appearance, size, and quality. The production of the other citrous fruits is very limited, and in the order of their importance they are: Pomelo (*Citrus grandis*), calamondin (*C. mitis*), lime (*C. aurantifolia*), orange (*C. sinensis*), cabuyao (*Papeda histrix*). The variation in these species is very great and several natural hybrids occur. (See Philippine Bureau of Agriculture, Bulletin No. 27.)

1993. Typical house near Manila. Roof made of nipa palm.

The mango (*Mangifera indica*) is the third most important commercial fruit in the Philippines and, excepting the mandarin, the only one that is exported. The three most important types of mangoes are Carabao, Pico and Pahutan. Only the first two are worthy of cultivation. Cavite, Cebu, Bohol, Nueva Ecija, Pangasinan and Zambales lead in mango-production. (See Philippine Bureau of Agriculture, Bulletin No. 18.)

1994. A typical laborer's hut in Manila. Also made of nipa palm.

The pineapple (*Ananas sativus*) is grown chiefly for its fiber and is cultivated principally in Samar, Occidental Negros, Tayabas and Bulacan. Bataan supplies Manila with pineapples during its season; the variety grown is of good quality and flavor. Cayenne and Spanish were introduced in 1912. The chico (*Achras Sapota*) is grown to a considerable extent and is of good quality; the guava (*Psidium Guajava*) is naturalized everywhere; the lanzon (*Lansium domesticum*) is well esteemed, and Manila is fairly well supplied with this fruit during its season. The soursop (*Annona muricata*) and the sugar-apple (*Annona squamosa*) are the most generally grown fruits of the genus; the custard-apple (*Annona reticulata*) is less esteemed. The duhat (*Eugenia jambolana*) is the most generally distributed species in the genus; the yambo (*Eugenia Jambos*) is very rare. The mangosteen (*Garcinia Mangostana*) and durian (*Durio zibethinus*) have not yet been introduced north of Mindanao.

1995. A hay (rice grass) carrier in Manila.

The betelnut (*Areca Catechu*) is of great local importance at present but the use of this stimulant is decreasing.

The above are the most important of the Philippine fruits. The following are grown to more or less extent: Alubihod (*Spondias mangifera*), alupag (*Euphoria cinerea*), bauno (*Mangifera verticillata*), bignay (*Antidesma bunius*), bitoñgol (*Flacourtia sepiaria*), bobog, (*Sterculia fœtida*), camanchile (*Pithecolobium dulce*), camia (*Averrhoa Bilimbi*), carambola (*Averrhoa Carambola*), cashew (*Anacardium occidentale*), catmon (*Dillenia philippinensis*), cereza (*Muntingia calabura*), chico-mamey (*Lucuma mammosa*), ciruela (*Spondias purpurea*), citron (*Citrus medica*), date (*Phœnix dactylifera*), fig (*Ficus Carica*), granadilla (*Passiflora quadrangularis*), grape (*Vitis vinifera*), iba (*Phyllanthus acidus*), igot (Eugenia sp.), jak (*Artocarpus integrifolia*), kambog (*Dillenia speciosa*), kaki (*Diospyros Kaki*), kayam (*Inocarpus edulis*), lemoncito (*Triphasia aurantiola*), libas (*Garcinia Vidalii*), longan (*Euphoria Longana*), mabolo (*Diospyros discolor*), macopa (*Eugenia javanica* and *E. malaccensis*), manzanita (*Zizyphus jujuba*), marang (*Artocarpus odoratissima*), mulberry (*Morus nigra*), pangi (*Pangium edule*), pili nuts (*Canarium ovatum*, and *C. pacyphyllum*), pomegranate (*Punica granatum*), santol (*Sandoricum indicum*), strawberry (*Fragraria vesca*), tamarind (*Tamarindus indica*), togop, (*Artocarpus elastica*), zapote (*Diospyros Ebenaster*).

As the islands are becoming better explored, other fruits will undoubtedly be added to this list.

The following fruits have been introduced by the Bureau of Agriculture within the last few years:

The avocado (*Persea gratissima*), cherimoya (*Annona Cherimola*), roselle (*Hibiscus Sabdariffa*), hevi (*Spondias cytherea*), hogplum (*S. lutea*), tiess (*Lucuma Rivicoa* var. *angustifolia*), boracho (*Lucuma salicifolia*), ceriman (*Monstera deliciosa*), tree tomato (*Cyphomandra betacea*), caranda (*Carissa Carandas*), carissa (*Carissa bispinosa*), *Cecropia palmata*, pitanga (*Eugenia uniflora*), caymito (*Chrysophyllum Cainito*), *Dillenia indica*, ginepap (*Genipa americana*), *Phyllanthus emblica*, bael (*Ægle Marmelos*), cattley guava (*Psidium Cattleianum*), biriba (*Rollinia orthopetala*), casimiroa (*Casimiroa edulis*).

During the past year, the leading varieties of citrous fruits have been introduced from their respective countries; also a large collection of mango varieties from India.

The most important vegetables are the sweet potato, here called camote (*Ipomœa Batatas*), ubi (*Dioscorea alata*), bolót (*D. fasciculata*), ñame (*D. sativa*), and gabe (*Colocasia antiquorum*), of all of which there are several varieties. If the cassava (*Manihot utilissima*) may be classed as a vegetable, this is another of great importance. The tomato, eggplant, sitao (*Vigna Catjang*), patani (*Phaseolus lunatus*), sincamas (*Pachyrhizus angulatus*), squash (*Cucurbita maxima*), and pumpkin (*Cucurbita Pepo*) come next in importance.

The following vegetables are also grown in the Philippines: Apalia (*Momordica balsamina*), batao (*Dolichos Lablab*), beet (*Beta vulgaris*), buting (*Phaseolus vulgaris*), cabbage (*Brassica oleracea*), cadyos (*Cajanus indicus*), carrot (*Daucus Carota*), chile (*Capsi-*

cum minimum and *C. annuum*), coletis (*Amarantus oleraceus*), condol (*Benincasa cerifera*), cucumber (*Cucumis sativus*), endive (*Cichorium Endivia*), garlic (*Allium sativum*), lettuce (*Lactuca sativa*), libato (*Basella rubra*), magtambocao (*Canavalia ensiformis*), malungai (*Moringa oleifera*), melon (*Cucumis Melo*), mungo (*Phaseolus Mungo*), mustard (*Brassica juncea*), okra (*Hibiscus esculentus*), onion (*Allium Cepa*), pacupis (*Trichosanthes anguina*), panarien (*Tacca pinnatifida*), parsley (*Carum Petroselinum*), patola (*Luffa acutangula* and *L. ægyptiaca*), pea (*Pisum sativum*), pechay (*Brassica Pe-tsai*), potato (*Solanum tuberosum*), radish (*Raphanus sativus*), seguidilla (*Psophocarpus tetragonolobus*), turnip (*Brassica Rapa*), upo (*Lagenaria vulgaris*), watermelon (*Citrullus vulgaris*).

The sago palm (*Metroxylon Rumphii*) is indigenous in Mindanao and used by the inhabitants of that island in the preparation of sago.

The climatic conditions and soil for the cultivation of many of the spices are excellent. Certain species of vanilla grow wild in Mindanao and Luzon, and cinnamon (*Cinnamomum zeylanicum*) is indigenous to Mindanao. Black pepper (*Piper nigrum*), and ginger (*Zingiber officinale*) have been introduced, but nothing has ever been done to encourage systematic cultivation of spices. If the spice industry was properly fostered by the government until it was fairly well established, good varieties introduced and care taken to exclude dangerous fungi and insect enemies, it is believed that this industry would have a promising future in the Philippines.

It appears evident, from the researches made by E. D. Merrill, that there already was a botanical garden in existence in Manila in 1787, located where the Singalong Experiment Station of the Bureau of Agriculture now is. This was one of the first institutions of its kind established in the Philippines if not in the entire Orient. It was abandoned by the Spaniards, at what date is unknown.

The present botanical garden, so called, established in 1858, south of the Pasig River and west of Intramuros, containing an area of about 5 hectares, is a park rather than a botanical garden. The construction of Malate Park, intended to cover over 40 hectares is now in progress.

During the last two years, the Bureau of Education has paid special attention to school-gardening, which, if wisely persisted in, will undoubtedly greatly assist in elevating the standard of horticulture in the Philippines. Both the Bureau of Agriculture and the Bureau of Education are making large annual distributions of vegetable seeds, and the Bureau of Agriculture maintains two agri-horticultural demonstration farms, one located at Trinidad, Benguet, and the other in Iloilo. Coincident with the reorganization of the Bureau of Agriculture in force from the beginning of the fiscal year 1912, provision was made still further to extend the activity of the extension and demonstration work, and a division of horticulture was created. Much work has already been accomplished by this division in collecting data relative to Philippine horticulture, and work is in progress to assemble all food plants for study at the experiment stations. (Relative to the activities of the Bureau of Agriculture, consult the "Philippine Agricultural Review," a monthly publication issued by the Bureau.)

The Philippine Agricultural College, Los Baños, provides a course in horticulture and maintains a garden and nursery for practical demonstration work.

P. J. WESTER.

ISMÈNE: *Hymenocallis.*

ISNÁRDIA: *Ludwigia.*

ISOCHÌLUS (Greek, *equal lip*). *Orchidàceæ*. A group of tufted orchids, little cultivated. Plants epiphytic, with tall, slender, leafy sts., without pseudobulbs, bearing a few small fls. at the summit: sepals erect, free, keeled; petals similar but plane; labellum like the petals and united with them to the base of the column, somewhat sigmoid below the middle; column erect, long, without wings; pollinia 4.—About 5 species, Trop. Amer.

linearis, R. Br. Fig. 1996. Slender, ¾–1⅓ ft. high, leafy: lvs. distichous, linear, striate, obtuse, emarginate, 1½ in. long: fls. purple, borne in a short, terminal spike. March. Growing on rocks and trees in thick woods, Jamaica, Trinidad, Brazil, etc. B.R. 745. L.B.C. 14: 1341. **I. màjor**, Cham. & Schlecht., of Mex., is taller, fls. larger and darker colored. HEINRICH HASSELBRING.

ISÓLEPIS: *Scirpus.*

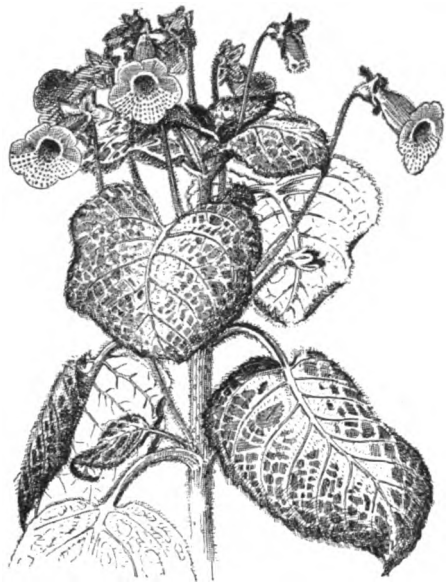
1996. Isochilus linearis. (×⅓)

ISOLÒMA (*equal border*). Includes *Tydæa, Gieslèria, Sciadocàlyx, Brachylòma. Gesneriàceæ.* Greenhouse plants, very closely allied to Gesneria and Achimenes.

From Gesneria it is distinguished by absence of well-formed tubers and characters of caps. and anthers, and the 5 lobes of the disk equal; from Achimenes in the more tubular fls. and lobed disk. From Vanhouttea and Diastema the genus is separated technically by the open æstivation. Herbs, with creeping rhizome or base or roots: lvs. opposite, usually villose as in Gesneria: fls. scarlet, orange or vari-colored, usually peduncled in the axils; corolla cylindrical, enlarged above, erect or declined, the limb subequally 5-parted.—Species perhaps 50 in. Trop. Amer.

The culture is the same as for achimenes and gesneria. Seeds of the newer hybrids come quickly, and plants bloom the same year. It is probable that the pure species are not in the trade. Like achimenes, gesneria and gloxinia, they have been much hybridized and varied. It is probable that they are hybridized with achimenes and gesneria. It is not known how the current forms have originated. Some of the recent ones have fringed flowers (Gn. 55:348). Because of the variation and hybridization in cultivation, the names in this group are much confused, although few of them appear to be in the trade. The confusion is increased, also, by change in the generic name, from Isoloma to Kohleria. The genus Kohleria was founded by Regel in Flora, April, 1848. Later in the same year, Decaisne founded Isoloma in Revue Horticole, taking up, however, the name from Bentham who had used it for a section of Gesneria in his "Plantæ Hartwegianæ" in April, 1846. In 1848, also, Decaisne founded the genus Tydæa on *Achimenes picta* of Bentham (1844); but this genus is now by common consent included in

Isoloma (or Kohleria). When this plant, which is apparently the best known garden form, is taken over into Isoloma, it would naturally become *I. pictum;* but the plant first regularly given the name *pictum* under Isoloma is *I. pictum* of Planchon, 1850–51 (and Regel, 1854), which is founded on the *Gesneria picta* of Hooker



1997. Isoloma bogotense. (×⅓)

(1849), and this is a very different plant from the cultivated *Achimenes* (or *Tydæa*) *picta*, and the latter must take a new name; and it assumes the name given it by Nicholson in 1888, *I. bogotense*.

bogoténse, Nichols. (*Achímenes pícta*, Benth., B.M. 4126, 1844. *Tydæa pícta*, Decne., R.H. 1848:468. *Kohlèria bogoténsis*, Fritsch, in Engler & Prantl, Nat. Pflanzenf. IV. 3*b*, 178, 1893. *Isolòma Tydæa*, Bailey, Cyclo. Amer. Hort. 836, 1900. *Isolòma pictum*, Hort., not Planch.). Fig. 1997. One to 2 ft., hairy: lvs. cordate-ovate, coarsely serrate, spotted and reticulated with pale green or silvery green, with a broad light zone down the center: fls. single, on long axillary sts., nodding, the orifice oblique and lobes obtuse, the upper longitudinal half of the fl. red, the lower half yellow and red-spotted. Colombia. B.M. 4126 (adapted in Fig. 1997). B.R. 31:42. F.S. 1:17, 18. *I. pictum*, Planch., F.S. 6:586 (*Gesneria picta*, Hook. B.M. 4431), is a different plant, apparently not in commerce.

amábile, Mott. (*Tydæa amábilis*, Planch. & Lind.). Erect, hairy: lvs. ovate, more or less tapering to the petiole, bluntly serrate, purplish on the veins: fls. hairy, pendent, dark rose dotted with purple, paler inside. Colombia. B.M. 4999. R.H. 1859, p. 25. F.S. 10:1070.

hirsùtum, Hort. Fig. 1998. Erect, hirsute on st. and lvs., free-flowering: lvs. ovate, acute, prominently petioled, close-toothed: fls. several on an axillary peduncle, hirsute, orange-scarlet, the rounded lobes darker-marked. Origin not clear. To be compared with the next.

eriánthum, Decne. (*Gesnèria eriántha*, Benth. *Brachylòma eriánthum*, Hanst. *Kohlèria eriántha*, Hanst.). Erect, 2–4 ft., the sts. and lvs. more or less fleshy and soft-hairy: lvs. long-petioled, ovate-lanceolate, dentate: fls. several on a peduncle, 1½–2 in. long, orange-red or cinnabar-red, the lobes rounded and the 3 lower spotted. Colombia. B.M. 7907.

Cecíliæ, Nichols. (*Tydæa Cecíliæ*, André). Much like *I. amabile*, but lvs. marked with violet and silvery zones or blotches: fls. 2 or 3 from each axil, the fls. pale rose outside and striped in the throat, and the limb purple-spotted. Colombia. I.H. 23:260.

ocellàtum, Benth. & Hook. (*Achímenes ocellàta*, Hook). Short-hairy on the st.: lvs. ovate-acuminate, serrate, green: fls. small, on peduncles shorter than the lvs., the tube and short, rounded lobes red, the segms. marked with whitish and black spots. Panama. B.M. 4359.

jaliscànum, Wats. Fig. 1999. Herbaceous or somewhat woody at the base, 1 ft., pubescent: lvs. opposite, oblong-lanceolate to ovate-lanceolate to ovate, short-acuminate, short-stalked, serrate: fls. 2–4 on an axillary peduncle, the corolla an inch long, tubular and short-lobed, pubescent, scarlet. Mex.—A worthy plant, probably not in the trade. L. H. B.

ISONÁNDRA (Greek, *equal anthers*). *Sapotàceæ. Isonandra Gutta* (=*Palaquium Gutta*, Burck.). is a large-leaved East Indian tree belonging to this genus, which furnishes the best commercial gutta-percha. The name has appeared in one southern catalogue, but the plants were found to be not true to name. This plant should be called *Palaquium Gutta*. In Palaquium the floral parts are in sixes, stamens twelve and the seeds have no albumen, while in Isonandra the floral parts are in fours, the stamens eight, and the seeds albuminous.

Gútta, Hook. (properly *Palaquium Gútta*, Burck.) One of the GUTTA-PERCHA TREES. Lvs. leathery, elliptic, abruptly pointed, 4 in. or more long, rusty-tomentose beneath, the primary nerves 24–30 on each side: fls. in axillary clusters on very short pedicels, the corolla ½in. long and with 6 elliptic obtuse

1998. Isoloma hirsutum. (×½)

lobes; stamens 12; ovary 6-celled, becoming a small ovoid berry with 1 or 2 seeds: tree 40 ft. This is scarcely a horticultural subject. Malaya. R.H. 1898, p. 441.

ISOPŸRUM (from the Greek for *like*, and *wheat*, as the seeds resemble those of wheat). *Ranunculàceæ*. Dwarf stemless herbs sometimes used in the wild garden. Annual, or rootstock perennial: lvs. decompound,

1999. Isoloma jaliscanum. (×½).

ternate; lfts. 3-lobed or cut, membranous: fls. white, regular, few or solitary, on slender scapes; sepals 5–6, deciduous; petals 5, very small or wanting: carpels 2–20, sessile; ovules 3 or more.—Fifteen to 20 species in temperate regions of the northern hemisphere. **I. thalictroìdes,** Linn., is cult. in alpine gardens, and has graceful foliage resembling a maidenhair fern. Six to 12 in. high: rootstock creeping: cauline lvs. alternate, 3-lobed or 3-foliolate: fls. white, resembling an anemone, in few-fld. terminal panicles; sepals oval, obtuse. W. Himalayas. April, May.—Thrives in any good garden soil. Prop. by seeds or by division of the roots in autumn. Very ornamental and good in masses. **I. grandiflòrum,** Fisch. Lvs. long-petioled; lfts. small, 2–3-lobed: scapes 3–4 in., equaling the lvs.; fl. solitary, 1–1¼ in. diam. Himalayas. G.C. III. 50:396.

L. H. B.

ISÓTOMA (Greek, *equally cut* or *divided;* referring to the corolla, and true only by contrast with Lobelia). *Campanulàceæ*. Lobelia-like herbs, but with an entire corolla-tube (or only partially slit), and stamens attached near the top of the corolla: lobes of corolla 5 and nearly equal, spreading; upper anthers with terminal tufts: fls. solitary or in racemes, blue, purple or white (at least in the cult. species): lvs. alternate, entire, dentate or pinnatifid or even twice-pinnatifid: plants of various habit, some species erect, others creeping or acaulescent; annual or perennial.—Species 8, of which 6 are Australian, 1 W. Indian, and 1 in the Society Isls.

axillàris, Lindl. Perennial, flowering the first year so as to appear annual, but forming at length a hard rootstock, erect, with few spreading branches, 6–12 in.: lvs. linear, irregularly pinnatifid, 2–3 in. long, lobes linear: pedicels axillary, 2–6 in. long; fls. large, bluish purple, pale outside. Austral. B.M. 2702 (as *Lobelia senecioides*) and 5073 (as *Isotoma senecioides* var. *subpinnatifida*, which has the lobes again more or less pinnatifid). B.R. 964.—Probably not now in cult.

petræa, F. Muell. Like the above, except that the lvs. are ovate-oblong or elliptical, with linear or lanceolate teeth or lobes which are not longer than the breadth of the body of the blade. Austral.—The plant in the trade is said to have cream-colored fls., and is sold as a "lemon verbena," a name which properly belongs to *Lippia citriodora*.

L. H. B.

ISÒTRIA (Greek, *in equal threes*). *Orchidàceæ*. Terrestrial plants, with elongated fleshy roots, and scapose stem with a whorl of leaf-like terminal bracts. Flowers solitary or in 2's, erect or ascending; sepals narrow, about equal, longer than petals; lip somewhat 3-lobed, spurless, erect, crested; pollina 2, powdery-granular, tailless.—Species 2, E. U. S. See *Pogonia*.

verticillàta, Raf. (*Pogònia verticillàta*, Nutt.). Scapes 8–16 in. tall; bracts elliptic to oval, abruptly acuminate; sepals linear, 1–2 in. long, longer than the linear petals; lip erect, 3-lobed. E. U. S. B.B. 1:468.

GEORGE V. NASH.

ISOTŸPUS: *Onoseris*.

ÌTEA (Greek name of the willow, applied here because it has willow-like leaves, or perhaps because it grows near the water). *Saxifragàceæ;* by some placed in a separate family, *Iteàceæ*. Trees and shrubs, numbering about 6 species, inhabiting tropical and subtropical Asia, and one of them in North America, *I. virginica*, a low, upright, somewhat coarse shrub, best known by its long, erect racemes of small white flowers appearing about July 1, in Massachusetts, and its brilliant autumn coloring.

The genus is characterized by alternate, narrow lvs., fls. in simple racemes which are terminal or axillary, white: calyx 5-toothed, with persistent lobes; petals 5, very narrow; stamens 5; ovary oblong, 2-celled: fr. a very narrow or a conical caps., which is 2-grooved, 2-parted when mature: some of the species are evergreen.

virgínica, Linn. VIRGINIAN WILLOW. Fig. 2000. A shrub, 1½–6 ft. high, usually not more than 2–3 ft. high, of upright, somewhat slender habit: lvs. deciduous, alternate, oblong, pointed, minutely serrate, smooth green above, pale and slightly pubescent below, petioled, without stipules, 1–3 in. long: fls. fragrant,

2000. Itea virginica. (×¼)

white, in solitary, erect, hairy, simple, dense, terminal racemes 2-6 in. long, given a greenish white effect by the stamens and pistils, not particularly showy, appearing late June and July. Pa. and N. J. to Fla. and La. B.M. 2409.—In nature it inhabits low, wet places. In cult. it seems to adapt itself to almost any soil. It is not perfectly hardy N., but grows rapidly and seems enduring of both sun and shade. In ornamental use it is planted in masses or mixed with other shrubs of similar character in the shrubby border or at the edge of woods. Its somewhat coarse character does not favor its approach to more refined objects. In autumn it becomes a brilliant red. It is prop. from seed, by cuttings and by division of roots, which spread slowly and form clumps of sts. It may be collected from the wild.

ilicifólia, Oliver. Evergreen shrub, with holly-like spiny-toothed broadly elliptic lvs.: fls. small, greenish white, almost sessile, in a terminal drooping raceme 1 ft. or less long. Cent. China. G.C. III. 34:375; 42: 123; 50:96. G.M. 54:567.—Hardy in parts of England.

A. PHELPS WYMAN.
L. H. B.†

IVA (named after *Ajuga Iva*, from its similar smell). *Compósitæ*. A genus of about twelve species of American shrubs or shrubby herbs with flowers suggesting those of Artemisia, or the common ragweed, but from which it differs in having heads all of one kind, the bracts of the involucre not united. This includes **I. frutéscens,** Linn, the MARSH ELDER or HIGH-WATER SHRUB, a native hardy perennial of no garden value, which is, nevertheless, on record as having been cultivated. It grows 3 to 12 feet high in salt marshes and on muddy seashores, has serrate leaves and flowers as inconspicuous as those of a ragweed. See B. B. 3:292 and the manuals.

IVÊSIA: *Potentilla.*

IVY. The common or English ivy is Hedera. **Boston I.**—*Parthenocissus tricuspidata.* **German I.**—Climbing Senecio and *Herniaria glabra.* **Ground I.**—*Nepeta Glechoma.* **Kenilworth I.**—*Linaria Cymbalaria.* **Poison I.**—*Rhus Toxicodendron.*

IXIA (Greek, *bird-lime;* said to refer to the juice). *Iridàceæ*. Attractive bulbs (cormose) from the Cape of Good Hope, with grass-like foliage and spikes of flowers in early spring, exhibiting a wide range of colors; usually flowered under glass, but can be grown in the open in the North with good protection.

Corm mostly globose, tunicated, fibrous-coated or nearly naked: st. simple or the infl. branched, about 1-2 ft. tall, bearing an erect spike or raceme of mostly 6–12 fls.: lvs. at the base of the st., erect, with perhaps a few smaller cauline ones: fls. funnelform or salverform with a slender sometimes elongated tube, and 6 nearly or quite equal segms., the colors white, yellow, orange, lilac, pink, crimson, red, purple or even green; stamens 3, attached in the throat, the filaments free or connate at the base; ovary obovoid or oblong, 3-celled and many-seeded, the style filiform with slender lobes: fr. a membranaceous obtuse 3-valved caps.—Species about 25 in S. Afr., 1 in Trop. Afr.

Ixias number their cultivated forms by the hundreds. Next to crocuses and freesias they have no rivals in point of popularity among spring-blooming bulbs of the iris family. Culturally they belong to the same class with babiana and sparaxis, which are also desirable and distinct in general appearance and coloring, but are surpassed by ixias in popularity and in number of varieties. Botanically, these three genera belong to the ixia tribe, in which the flowers are spicate, not fugitive and never more than one to a spathe. The stamens of Ixia are equilateral; those of Babiana and Sparaxis unilateral. Ixias have about six erect grass-like leaves arranged in two ranks; Babiana has plaited, hairy leaves. Bulb catalogues give no hint as to the parentage of the numerous named varieties. They may not mention *I. maculata* nor *I. columellaris*, which are probably the important parent stocks. Of the species recognized by Baker in Flora Capensis, apparently only *I. viridiflora* appears as a trade name, but *I. speciosa* and *I. paniculata* may be advertised under their synonyms *I. crateroides* and *I. longiflora*. Ixia flowers are charming in every stage of development. At first the flowers are erect and cup-shaped. They close at night and remain closed on dark days. As they grow older they open wider and become more star-shaped. Fig. 2001 shows the flowers in their drooping stage. The plants remain in flower for three weeks, although the faded flowers at the bottom of the spike should be taken off toward the end of the period. As cut-flowers, they are presentable for a week or two.

2001. Ixia flowers in their drooping stage. (×½)

For greenhouse bloom, ixia bulbs can be planted any time from September 15 to October 30, the sooner the better. In general, tender bulbs of small size tend to lose vitality when kept a long time in the dry air of warehouses. They should be planted an inch deep, five or six in a 5-inch pot, or eight to ten in a 6-inch pot. They like a compound of sandy soil and leafmold. It is probable that most of the failures with ixias are due to hasty forcing. The pots should be stored under a bench or in a rather dark cellar, at a temperature of 45°. The object is to hold back the tops while the roots are growing, in order to get stocky, well-colored, slowly started shoots. They need no water until growth has started. Then water carefully until the flowers come, as the young plants are liable to rot at the surface of the ground. While flowering, water freely. After flowering, some gardeners give the plants no water. Others keep the soil moist until the leaves turn yellow, and then gradually withhold water. As to temperature, the plants may be brought into a cool greenhouse (50°) when well started, and toward the end of January may be given 5° more heat if flowers are desired as early as the middle of March. Ixias have to be staked and tied. The old bulbs, from which the offsets have been removed, may be used again. Ixia bulbs, which are really fibrous-coated corms about ½inch thick, keep as well as freesias. Seedlings flower the third year.

In coldframes ixias give good results. Choose for the frame an open place, sheltered from north and west winds. In its construction give especial care to providing good drainage, to close-fitting and snug banking, so that frost, mice and moles can be kept out. A sandy soil, without manures, is safest and best for ixias. If fertilizers are used, they must be placed several inches below the bulbs, never in contact with them. As in outdoor culture, the bulbs must be planted late and in soil well dried by placing the sashes over the frame some time beforehand. Plant about 3 inches deep, as far apart, and treat afterward much as in greenhouse culture. Take off the sashes in early May to show the mass of rich, odd flowers which, ordinarily, will open about that time and last for several weeks. If the

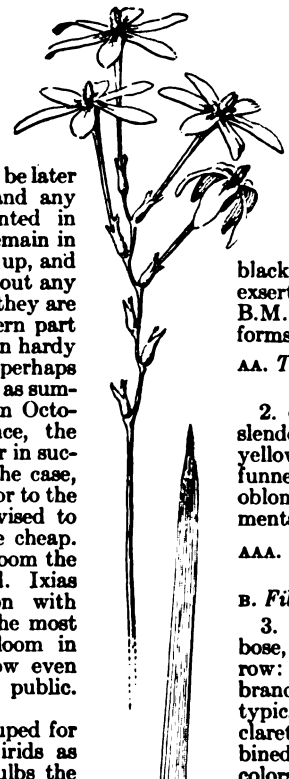
frame is to have other tenants through the summer, the ixias may be taken up after their tops are dead and stored in dry sand till planting time comes around again. Otherwise, merely cease watering as the tops of the ixias die down, and put on the sashes again, tilting them so that they will give air and shed rain. (L. Greenlee.)

Outdoor culture of ixia is likely to be more satisfactory than indoor culture, if one meets the few simple requirements. The planting of the bulbs should be delayed until the last moment, because ixias are more inclined than most things to make an autumnal growth. They should be planted 3 inches deep as late as November 30. In planting bulbs it is always well to sprinkle a handful of sand on the spot where they are to lie. This helps the drainage, especially on heavy lands, and prevents rotting. The bulbs should then be covered with about 3 inches of leaves, hay, or better still, pine-needles. In the latitude of Boston, ixia beds can be uncovered during the first week of April. However, there will still be sharp frosts to nip the tender shoots that have started beneath the winter covering. Consequently a little hay or other covering material should be left nearby, where it can be easily secured when a chilly evening threatens. In ten days the young sprouts will become sufficiently hardened to withstand any subsequent cold. Even such hardy things as alliums, when first uncovered, can hardly withstand any frost at all. It is, however, a mistake to wait two weeks longer and then permanently uncover the bulb beds, for by that time the early-starting things are likely to be so lank and long that they never attain ideal sturdiness. It is better to uncover too early than too late. The secret of success with ixias outdoors is largely in hardening the plants in early spring and in never allowing them to grow too fast under cover, where they become yellow and sickly. In winter, shutters may be placed over the bulb beds to shed the rain; but the bulbs do as well without this protection, though they may be later in starting. Of course, ixia bulbs cannot stand any freezing, and they must, therefore, be planted in unfrozen soil.—After flowering, let the bulbs remain in the earth until the end of July; then take them up, and store them, not in dry earth, but in boxes without any packing. Let them remain in a dry place until they are wanted for November planting. In the southern part of England, ixias can be planted 6 inches deep in hardy borders as late as December, and Krelage, perhaps thinking of still warmer regions, considers ixias as summer-blooming bulbs, and advises planting from October to December.—In the writer's experience, the flowers from the old bulbs are not at all inferior in succeeding years: indeed, the contrary has been the case, and the bulbs raised at home have been superior to the ones purchased. Amateurs are commonly advised to throw away the offsets because fresh bulbs are cheap. Yet the writer finds that many of the offsets bloom the first year and nearly all of them the second. Ixias have been raised commercially near Boston with every prospect of success. Ixias are amongst the most pleasing of all bulbs. With thousands in bloom in the month of June, they make a braver show even than tulips, and they are less known to the public. (W. E. Endicott.)

In California, ixias, with which may be grouped for cultural purposes such other South African irids as sparaxis, babianas, and tritonias, are of all bulbs the best adapted to California conditions, thriving outdoors with the minimum of care, increasing very rapidly by offsets, and even forming colonies from self-sown seed. Planting should be done as soon as the imported bulbs are available, usually in October. They should be put about 2 inches deep and as far apart as taste dictates, —say 3 inches, if space is valuable. Good drainage is essential and a sandy loam much better than heavy adobe, although the writer has grown them successfully in both. Divide every alternate year to prevent crowding. Pick the brightest place in the garden, as the flowers require strong sunlight to open them up well. This is especially true of the green kind, *I. viridiflora*.—To raise new varieties, sow seed in autumn, the resultant bulbs blooming the second season. Some of the best varieties in California are self-sown seedlings, the result of crosses between good named varieties in neighboring beds. After a start has been made, there is no reason why the American supply of these bulbs should not be grown in California, as they ripen very well and are of greater vigor than the imported ones.—Where space is limited, ixias may be planted among daffodils, thus renewing the show a month after the latter are over. As both bulbs ripen together, in harvesting this is no drawback. For garden effect, large plantings of separate, clear-colored, named varieties are much better than mixtures. The flowering season covers about six weeks, the pretty cerise *I. speciosa*, (*I. crateroides*) blooming in March, while the brilliant brick-red Vulcan is sometimes as late as May. (Sidney B. Mitchell.)

INDEX.

aristata, 8.
bicolorata, 9.
cæsia, 4.
cana, 4.
columellaris, 6.
crateroides, 13.
elegans, 8.
flavescens, 9.
flexuosa, 11.
longiflora, 1.
lutea, 10.
maculata, 5.
monadelpha, 3.
nigro-albida, 5.
ochroleuca, 5.
odorata, 2.
ornata, 5, 9.
ovata, 7.
paniculata, 1.
patens, 12.
polystachya, 9.
speciosa, 13.
stellata, 7.
viridiflora, 4.



2002. Ixia paniculata. (×⅓)

A. *Tube of perianth long, and somewhat dilated below the limb.*

1. **paniculàta,** Delaroche (*I. longiflòra*, Berger). Fig. 2002. Corm ¾in. or less diam., with brown tunics: basal lvs. 2–3, linear and glabrous, to 1½ ft. long: st. 1–3 ft., sometimes branched: fls. many, in lax erect spikes, the tube to 3 in. long and straight, the limb cream-white, the segms. obtuse, often tinged red and sometimes with a blackish base; anthers wholly or partially exserted, about as long as the filaments. B.M. 256; 1502.—There are two botanical forms or varieties.

AA. *Tube of perianth short, and dilated below limb into a distinct funnelform.*

2. **odoràta,** Ker. Lvs. very narrow: st. slender, distantly branched: fls. bright yellow, fragrant, in a short spike; tube funnel-shaped, ½in. long, the segms. oblong; anthers equaling the free filaments. B.M. 1173.

AAA. *Tube of perianth short and cylindrical (not dilated upward).*

B. *Filaments more or less connate or joined.*

3. **monadélpha,** Delaroche. Corm globose, with fibrous coverings: lvs. very narrow: st. slender, simple or somewhat branched: fls. few, in a short spike; segms. typically lilac, but there are forms with claret-red, blue or pale yellow segms. combined with eyes and markings of various colors, some of which have received separate names. B.M. 607; 1378.

BB. *Filaments all free at the base.*

C. *Fls. green.*

4. **viridiflòra,** Lam. Corm depressed-globose, ½in. diam., with fibrous covering: lvs. narrow, strongly ribbed: fls. many, in a long loose erect spike, typically with

pale green segms. and black throat. B.M. 549. L.B.C. 16:1548. F.S. 2:124. Var. **càna,** Eckl. Segms. pale blue; throat black. B.M. 789 (as *I. maculata amethystina*). Var. **cæsia,** Ker. Segms. pale lilac; eye greenish. B.R. 530.

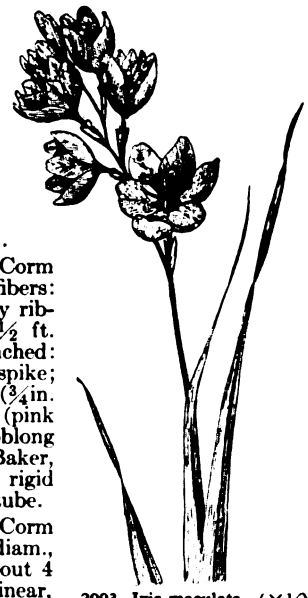
CC. *Fls. in other colors.*

D. *Throat of fl. (eye) differently marked from the segms.*

5. **maculàta,** Linn. Fig. 2003. Corm globular, 1 in. or less diam., covered with parallel fibers: lvs. about 4, linear, ribbed, 6–12 in. long: sts. slender, 1–2 ft., simple or branched: fls. many, in dense and erect spikes, typically yellow; tube slender; limb bell-shaped, with a dark purple or black mark at throat, the segms. oblong, obtuse. B.M. 539 (orange, as *I. conica*). The natural varieties show the range of color: Var. **ochroleùca,** Ker. Segms. sulfur-yellow; eye brown. B.M. 1285. Var. **nigro-álbida,** Klatt. Segms. white; eye black. Var. **ornàta,** Baker. Fls. flushed bright red or purple outside.

6. **columellàris,** Ker. Like *I. maculata*, but fls. typically with bright mauve-purple segms. and blue throat. B.M. 630.

7. **ovàta,** Klatt. Like *I. maculata*, but has bright red fls. with purple-black throat. Var. **stellàta,** Klatt, has the throat yellow.



2003. Ixia maculata. (×⅓)

DD. *Throat not differently marked.*

E. *Color white or whitish (varying to tinted shades and colors).*

8. **arístàta,** Ker. Corm globose, with strong fibers: lvs. 3–4, linear, strongly ribbed: st. slender, to 1½ ft. high, simple or branched: fls. many, in a loose spike; perianth-tube slender (¾in. or less); limb whitish (pink in B.M. 589), with oblong segms. Var. **élegans,** Baker, has narrower and less rigid lvs., and much shorter tube.

9. **polystàchya,** Linn. Corm globose, ¾in. or less diam., with fine fibers: lvs. about 4 at base and 2 on st., linear, strongly ribbed, 6–12 in.: st. slender, 1–2 ft., simple or branched: fls. many, in erect spikes; perianth-limb white, the segms. oblong; filaments short. B.M. 623 (as *I. erecta*). Var. **ornàta,** Baker. Segms. tinged red outside. Var. **bicoloràta,** Baker. Fls. pale yellow, tinged violet outside. Var. **flavéscens,** Baker. Fls. pale yellow.

EE. *Color yellow or orange.*

10. **lùtea,** Baker. Corm globose, ½in. diam., with fibrous covering: lvs. linear, 6–12 in. long: st. slender, 1–2 ft., simple or branched: fls. many, in a dense spike, deep bright yellow. B.M. 846.

EEE. *Color shades of red or lilac.*

11. **flexuòsa,** Linn. Very like *I. polystachya*, except that fls. are in shades of red or lilac or lilac-tinged outside. B.M. 624.

12. **pàtens,** Ait. Corm globose, to ¾in. diam., with fine fibers: lvs. about 4, linear, 6–12 in.: st. erect, 12–18 in., sometimes branched: fls. several, in a somewhat dense erect spike, pale red.

13. **speciòsa,** Andr. (*I. crateroìdes*, Ker.). Corm globose, small, with matted fibers: lvs. from base about 6, linear: st. slender, usually simple: fls. few, in a short and erect spike, the oblong segms. dark crimson; limb campanulate. B.M. 594. Gn.W. 21:648.

WILHELM MILLER.
L. H. B.†

IXIOLÍRION (Greek, an *ixia-like lily*). *Amaryllidàceæ.* Three or four species of hardy bulbs from western and central Asia, with umbels of deep blue or violet six-lobed flowers, borne in spring.

Perianth regular, without tube above the ovary; segms., oblanceolate, acute; stamens shorter than the segms., attached to their claws; ovary club-shaped, 3-celled, becoming a 3-valved caps.: lvs. very narrow, mostly at base of the st. The nearest cult. allies are Alstrœmeria and Bomarea, which have no distinct rootstock, while Ixiolirion has a bulbous rootstock. The bulbs should be lifted in autumn and stored.

montànum, Herb. (*I. Pállasii*, Fisch. & Mey.). Bulb ovoid, 1 in. thick, with a neck 2–3 in. below the basal tuft of lvs.: st. about 1 ft. long: lvs. about 4, persistent, and a few smaller ones above: fls. on long unequal pedicels, about 4, and often 1 or 2 fls. below; perianth bright lilac according to Baker, 1½ in. or less long. Syria to Siberia. B.R. 30:66. F.S. 22:2270. R.H. 1880:310. J.H. III. 31:583.

Var. **tatáricum,** Herb. (*I. tatáricum*, Hort. *I. Lédebourii*, Fisch. & Mey.). Sts. more slender: lvs. awl-shaped: fls. all in a terminal umbel, smaller than the type. Altai Mts. G.C. II. 19:757. Gn. 75, p. 188. Gn. W. 21:685. J.H. III. 42:532.

I. Kolpakowskiànum, Regel (Kolpakowskia ixiolirioides, Regel), is perhaps a form of above, but has a smaller bulb, fls. 2–4 in a terminal umbel, and the perianth-segms. ¾–1 in. long: lvs. about 4 in a basal tuft and 1 or 2 small ones above. Turkestan. Gt. 1878:953.

L. H. B.

IXÒRA (a Malabar deity). *Rubiàceæ.* Warmhouse woody plants with showy flowers in clusters and evergreen foliage; handsome and desirable.

Shrubs or small trees with opposite or verticillate lvs. and terminal or axillary usually dense corymbs of very showy white, rose or scarlet fls. on bracteate pedicels: corolla very long and slender-tubed, the throat sometimes barbed, the limb 4- or 5-lobed and wide-spreading; stamens 4 or 5, inserted on the throat, the filaments short or none; ovary on a fleshy disk, 2-loculed, the style filiform and exserted, 2-branched; ovules solitary: fr. a hard or fleshy 2-pyrenous berry.—Species upward of 150, in the tropical parts well around the globe.

There are many garden forms of Ixora under Latin names, and these complicate a botanical account of the genus. Some of the named garden ixoras are the following: *Amabilis,* pinkish, suffused orange. *Aurantiaca,* orange-red; compact. *Chelsonii,* fls. brilliant salmon-orange. *Colei,* fls. pure white: cross of *I. coccinea* and *I. stricta* var. *alba. Conspicua,* fls. yellow, becoming orange. *Decora,* yellow. *Dixiana,* fls. deep orange; G. 27:363. F. S. R. 3, p. 275. *Fraseri,* fls. scarlet in the tube, and brilliant salmon above; G. 7:529. *Illustris,* orange. *Incarnata,* flesh-color. *Insignis,* rose. *Ornata,* salmon-orange. *Pilgrimii,* orange-scarlet. *Princeps,* fls. whitish, becoming orange; said to have come from Java. *Profusa,* rose. *Regina,* fls. shaded violet-salmon, in large dense clusters. J.H. III. 42:159. *Sanguinea,* fls. crimson, shaded with violet. *Speciosa,* yellow. *Splendens,* orange. G.Z. 23:193. *Splendida,* crimson-orange. G.Z. 26, p. 217. I.H. 29:463. *Venusta,* orange. *Westii,* fls. pale rose, becoming brilliant; hybrid. Gn. 42:496. G.M. 36:35. G. 25:457. *Williamsii,* fls. reddish salmon.

The ixoras are perhaps the best tropical warmhouse plants that combine the showiest of flowers with fine evergreen foliage. They are of easy culture, and should be far oftener seen in tropical plant-houses.—They may be propagated at any season, but early spring is probably best. Take good strong cuttings, with four

pairs of leaves on them, and pot them singly, in 2-inch pots, in two parts clean sharp sand, and one of peat. Plunge the small pots in a cutting-bed, where the bottom-heat is about 70°. Be sure they are shaded from the strong sun. In a few weeks the small pots will be filled with roots, and the plants may be shifted into a pot two sizes larger, and removed from the propagating-bed, and placed in a light position in a house where the night-temperature is about 65°.—The compost in which they are potted may be equal parts of fibrous loam, peat, and sand, adding about a sixth part of broken charcoal. When they grip the soil in this pot, cut them back, leaving two joints above the earth. If desired, the plants may be flowered in the smallest size of pot, and for decorative work they are then very useful; but if large plants are wanted quickly, keep them growing right along, never allowing the ball of the plant to get into a mat of roots until the desired size of pot is reached. After they have reached a 6-inch pot, they give the best satisfaction, if they are potted entirely in the fiber of a good loam, all the fine material being shaken out of it. Pot them rather firmly and keep up a night temperature of 65°. In winter it may be 5° less. —From March until the end of September, a very light shade over them is necessary, to keep the foliage in a perfect condition. After flowering is the best time to trim these plants into shape. Cut them back to one joint, unless some of the shoots are required longer, to preserve the symmetry of the plant. Before pruning ixoras, it is a good plan, after flowering, to keep them on the dry side for about a month. Never, however, allow the plants to suffer for lack of water. Just let them get to the wilting point, then water. This treatment firms up the wood equally, and when they are cut back, the young growths start all at the same time. By following this method the plant will flower more equally all over. Large plants of some of the varieties will give three crops of flowers a year; the variety *Fraseri* is an example. Plants in large pots will do well for several years without repotting, if fed liberally with manure-water. Green cow-manure, fertilizers such as Clay's soft-coal soot, an ordinary handful to a two-and-a-half-gallon watering-pot, or, for a further change, horse-urine, a 3-inch potful to the same amount of water, agrees well with ixoras, when they are well rooted. Water twice between applications with clean water. Insects that affect ixoras may be kept in check by a judicious use of the syringe, and fumigations with hydrocyanic gas as advised for other plants. (George F. Stewart.)

INDEX OF BOTANICAL SPECIES.

(For horticultural names, consult a preceding paragraph.)

acuminata, 2.
amboinica, 13.
Bandhuca, 7.
barbata, 3.
blanda, 6.
chinensis, 6.
coccinea, 6, 7, 12.
congesta, 10.
crocata, 6.
Duffii, 8.
fulgens, 9.
grandiflora, 7.
Griffithii, 10.
javanica, 11.
laxiflora, 5.
lutea, 12.
macrothyrsa, 8.
odorata, 4.
parviflora, 1.
rosea, 6.
salicifolia, 9.
stricta, 6.

A. *Fls. white (sometimes tinged pink).*

1. **parviflòra,** Vahl. Evergreen tree, with subsessile oblong or elliptic-obtuse lvs. 3–6 in. long: cymes sessile, with 3–5 pairs of short branches, the fls. in subglobose clusters; corolla white, glabrous, the tube only ⅓in. long, and the lobes oblong. India.

2. **acuminàta,** Roxbg. Glabrous shrub: lvs. various, from elliptic to linear-oblong, or the floral sometimes rounded or obovate and sessile while the others are petioled: cymes corymb-like, contracted and densely fld. sometimes as if almost capitate, 2–4 in. across; corolla pure white and fragrant, ⅔in. across, the lobes narrow and obtuse. India.

3. **barbàta,** Roxbg. Large glabrous shrub: lvs. stalked, elliptic, somewhat acute, thin, the upper pair usually small and sessile and cordate: cymes much broader than high, short-stalked, sometimes 1 ft. across, the branches being long, slender and spreading; corolla white, wooliy at the mouth, the tube 1–1½ in. long and lobes narrow. India. B.M. 2505; 4513. J.F. 1:26.

4. **odoràta,** Hook. Small shrub: lvs. large, broad-ovate or obovate-lanceolate, acute or acuminate, thick, to 1 ft. long, the lower ones attenuate to a petiole: cymes or panicles much divided, 1 ft. or more across, with purplish branches; corolla very long (4–5 in.), white changing to yellowish brown; stamens somewhat protruding; fls. very fragrant. Madagascar. B.M. 4191.

5. **laxiflòra,** Smith. Shrub, slender, 3–4 ft.: lvs. oblong-lanceolate, acuminate, short-petioled: cymes or panicles trichotomous and very open, large, terminal;

2004. Ixora congesta. (×⅓)

corolla white tinged pink, the tube 1½ in. long, limb cut to the base and the lobes very distinct; calyx red; fls. very fragrant. Guinea. B.M. 4482. J.F. 1:21.

AA. *Fls. usually in shades of red (sometimes varying to rose and to orange-scarlet).*

6. **chinénsis,** Lam. (*I. stricta,* Roxbg. *I. coccínea,* Hort., not Linn. *I. blánda,* Ker. *I. crocàta,* Lindl. *I. ròsea,* Sims). Apparently the common species, known in greenhouses as *I. coccinea:* glabrous shrub, with sessile or subsessile lvs. which are obovate or obovate-oblong, and slender-tubed fls. in dense corymbs, the corolla-lobes short and rounded and the tube ¾–1 in. long. Malayan archipelago and China. B.M. 169 (as *I. coccinea*); 2428. B.R. 100; 782.—Runs into nearly pure white forms. There are said to be yellowish fld. forms. Prince of Orange, a popular variety, is said to be a form of this species.

7. **coccínea,** Linn. (*I. grandiflòra,* Bot. Reg. *I. Bandhùca,* Roxbg.). Much like the last, but lvs. oblong with mostly rounded or cordate base and sometimes an

apiculate tip, and corolla-lobes broad and acute, and the tube 1–1¾ in. long. E. Indies. B.R. 154; 513.

8. **macrothýrsa,** Teijsm. & Binn. (*I. Dúffii,* Moore). Very large, glabrous: lvs. a foot long, linear-oblong to oblong-lanceolate: cluster very large, 8 in. across, bearing very many deep red tinged crimson fls., with lanceolate obtuse lobes about ½in. long. E. Indies. B. M. 6853. G.M. 50:582. F.E. 19:115.—One of the finest of the genus.

AAA. *Fls. in shades of yellow or orange.*

9. **fúlgens,** Roxbg. (*I. salicifòlia,* DC.). Shrub with erect slender polished branches: lvs. petioled, linear-oblong to obovate-oblong, more or less acute or acuminate, shining above and with 20–30 pairs of sunken nerves: cymes sessile or short-peduncled, corymb-like, large, with spreading slender branches, the fls. short-pedicelled; fls. orange-scarlet or orange becoming scarlet; calyx-teeth very short and obtuse; corolla-tube 1¾ in. or less long, the lobes ovate and acute. India. B.M. 4523. J.F. 1:38.

10. **congésta,** Roxbg. (*I. Griffithii,* Hook.). Fig. 2004. Evergreen tree in its native haunts, glabrous except the cymes: lvs. very large (6–12 in. long), stalked, elliptic or elliptic-oblong, acute or acuminate: cymes sessile or nearly so; fls. orange-yellow, changing to reddish, the segms. rounded. India. B.M. 4325. J.F. 1:50.—Much like *I. fulgens,* differing in stouter habit, very large and usually coriaceous broader lvs., stout not spreading branches in the cyme, and the fls. sometimes sessile.

11. **javánica,** DC. Glabrous shrub with lvs. 4–7 in. long, ovate-oblong, acute or acuminate: corymb terminal, long-peduncled with forking coral-red branches; fls. deep orange-red, the lobes rounded, the corolla-tube 1½ in. long, slender, red. Java. B.M. 4586. J.F. 2:156.

12. **lûtea,** Hutchinson (*I. coccínea* var. *lùtea,* Hort.). Differs from *I. coccinea* by laxer infl. and pale yellow fls. with larger ovate-rhomboid corolla-lobes. Of garden origin. B.M. 8439.

13. **amboínica,** DC. Shrub: lvs. large, short-petioled, ovate-oblong, acuminate, undulate, glabrous: cyme (or corymb) trichotomously divaricately compound; corolla-lobes acute. Amboyna (Moluccas).—Apparently in the trade as *I. amboina,* with long-lasting "showy orange-yellow flowers."

L. H. B.

J

JABOTICÁBA. This name is applied in southeastern Brazil to the fruits of several species of Myrciaria, notably *M. cauliflora*, and *M. jaboticaba*, of the family Myrtaceæ. See *Myrciaria*.

The jaboticabeira, or jaboticaba tree, occurs not only in the wild state in various parts of Minas Geraes, São Paulo, Rio de Janeiro and adjoining states, but is commonly planted in gardens, and the fruit, which does not differ much in character among the various species, is held in the highest esteem by Brazilians of all classes. When well grown the tree is extremely handsome, reaching a height of 35 or 40 feet, with an umbrageous, dome-shaped head of light green foliage, the new growth pink. The persistent entire leaves are opposite, ovate-elliptical to lanceolate, acute or acuminate at the apex, generally glabrous, varying from ¾ inch to over 3 inches in length. The flowers are small, white, with four petals and a prominent cluster of stamens. They are produced singly or in clusters directly upon the bark of the trunk and limbs. The season of flowering and fruiting varies with the different species and in different localities; sometimes two or more crops a year are produced.

The fruit is nearly sessile or with a slender peduncle about 1 inch long, and is round or slightly oblate in form. It is ½ inch to 1–1½ inches in diameter, glossy, maroon-purple in color, and crowned with a small disk at the apex. The skin is thicker than that of a grape, and considerably tougher. The translucent, juicy pulp, white or tinged with rose, is of a most agreeable vinous flavor, remarkably suggestive of the grape, to which the jaboticaba is frequently compared. The seeds, one to four in number, are oval to round in outline, compressed laterally, ¼ to ⅜ inch long. When heavily laden with fruit, the tree is a curious sight. Not only is the trunk covered with glistening jaboticabas, but the fruiting extends out to the ends of the small branches as well.

The fruit is usually consumed when fresh, but in former days was used by the Indians for the manufacture of wine. It is sometimes made into jelly or jam. In the markets of Rio de Janeiro, jaboticabas sell for about 25 cents a pound, and considerable quantities are shipped in from Minas Geraes and São Paulo.

The tree prefers a soil that is rich and deep. Its growth is slow, six to eight years being required for it to come into bearing. Propagation in Brazil is almost always by seed, but inarching or some other vegetative means is necessary to perpetuate good varieties. There is much variation among seedlings. In California the jaboticaba makes very slow growth, and is adapted only to the most protected locations. It has been planted in Florida very recently, and may prove adapted to some sections of that state. When young the trees are very susceptible to frost, but when they have attained a few years' growth they will withstand slight frosts without serious injury. For a more complete account, see "Journal of Heredity," Vol. V, No. 7, 1914.

F. W. Popenoe.

JACARÁNDA (Brazilian name). *Bignoniàceæ*. Handsome tubular-flowered trees and shrubs, grown far South and also under glass.

Leaves opposite, 2-pinnate, rarely 1-pinnate; lfts. usually numerous, entire or dentate: fls. showy blue or violet, mostly in terminal or axillary panicles, often very freely produced; calyx small, 5-toothed; corolla-tube straight or curved, regular at the base or somewhat constricted above the ovary and broadened above; corolla-limb somewhat 2-lipped, the 5 lobes rounded and spreading and nearly equal; disk thick and cushion-like; perfect stamens 4, didynamous; staminode about as long as the stamens, club-shaped at the apex and often bearded at the top: fr. an oblong, ovate or broad dehiscent caps.—Species about 50, in the American tropics. Prop. by cuttings of half-ripened wood. Under glass they are considered to be warmhouse subjects.

ovalifòlia, R. Br. (*J. mimosæfòlia*, D. Don). Tree, 50 ft. and more: lvs. distant, spreading, oblong, villous: fls. blue (and a white variety) more or less horizontal. Brazil. B.R. 631. B.M. 2327. R.H. 1897:132. G.C. III. 36:224. G.M. 49:71.—*J. ovalifolia* perhaps ranks among the best flowering trees or shrubs for subtropical regions. It is now much recommended as a street tree in S. Calif., it being deciduous only in early spring. The foliage is as finely cut as a fern, symmetrical and elegant. The lvs. are decussate, distant, each one with 16 or more pairs of pinnæ, each pinna having 14–24 pairs of lfts. The plant bears loose, pyramidal panicles, 8 in. high, of 40–90 blue fls., each 2 in. long and 1½ in. wide, which have a long, bent, swelling tube and the 2 lobes of 1 lip smaller than the 3 other lobes. It is one of the best of foliage plants for the S., valuable alike for florists' decorations, conservatory, subtropical bedding in the N., or for lawn specimens in Fla., where, if cut back by frost, it rapidly recovers its beauty. It stands pruning well, and can be kept in regular form. There is some confusion between the names, *J. ovalifolia* and *J. mimosæfolia*, both being made in the year 1822.

cuspidifòlia, Mart. As compared with *J. ovalifolia*, lvs. said to attain a larger size and to have more lfts., fls. larger and in larger panicles, and brighter blue, tree more vigorous. Lvs. glabrous, with 8–10 pairs of lfts. and the lfts. again divided into 10–15 pairs, the ultimate lfts. entire, lanceolate, cuspidate at apex, the secondary rachis winged: fls. in large terminal thyrse, blue-violet, the corolla nearly 1½ in. long. Brazil, Argentina; advertised in S. Calif.

chelònia, Griseb. Tree, 30–90 ft., of globular shape: foliage fern-like, very ornamental: fls. large, blue, in strict terminal panicles 1 ft. long; calyx-lobes lance-linear and narrowly acuminate; corolla glandular-puberulent. Paraguay, Argentina.—Wood said to be veined with rose, and valued in S. Amer. for cabinet work.

acutifòlia, Humb. & Bonpl. Tree, glabrous: lvs. 2-pinnate, the lfts. 6–8 pairs and ultimate lfts. many and acuminate, entire, the petiole canaliculate and rachis winged: corolla silky, the tube straight, violet: panicle terminal and axillary. Peru.—Offered abroad.

L. H. B.†

JACK BEAN: *Canavalia.*

JACK-FRUIT: *Artocarpus integrifolia.*

JACK-IN-A-BOX: *Hernandia.*

JACK-IN-THE-PULPIT: *Arisæma.*

JACKSÒNIA (named for George Jackson, a Scotch botanist). Syn. *Piptómeris*. *Leguminòsæ*. Stiff, leafless shrubs or subshrubs, sometimes grown as greenhouse subjects: branchlets often phyllodineous or lf.-like, very much branched and spinescent: lvs. replaced by

very minute scales at the nodes: fls. yellow, or yellow and purple, in terminal or lateral racemes or spikes, or scattered along the branches: bracts small, scale-like. —About 40 species, principally in W. Austral. Jacksonias are rarely seen in cult. They thrive in loam and peat soil. Prop. by cuttings from half-ripened shoots, rooted in sand, during April. *J. sericea*, Benth. A large shrub, decumbent, ascending or tall, with pendulous branches: fls. solitary or in irregular, terminal, loose racemes; calyx-lobes linear, about as long as the corolla. W. Austral. L. H. B.

JACOBÆA: *Senecio.*

JACOBÍNIA (probably a personal name). Including *Cyrtanthèra*, *Libònia*, *Sericógraphis*, *Sericobònia*. *Acanthàceæ*. Plants cultivated under glass for their narrow-tubular red, orange or yellow flowers.

Glabrous herbs, or sometimes shrubs: lvs. opposite and entire: fls. variously disposed, sometimes solitary, sometimes fascicled or spicate; calyx deeply 5-parted, with linear or awl-shaped segms.; corolla more or less 2-lipped, 1 lip 2-lobed and the other 3-lobed; stamens 2; staminodia represented by 2 hairy elevations on the corolla-tube; disk ring-like or cupulate; pistil ripening into an oblong or ovate caps., the style filiform.—Species 20–40, depending in part on the definition of the genus, from Mex. to Bolivia and Brazil.

Jacobinias, in common with other acanthads, are much confused as to species. A closely allied genus is Justicia, which, among other characters, is distinguished by having spurs or appendages at the base of the anther-lobes, whereas Jacobinia has no such appendages. Most of the garden plants called Justicias are Jacobinias. Other allied genera are Aphelandra, Dianthera, Adhatoda, Thyrsacanthus, Eranthemum, Barleria, Dædalacanthus.

2005. Jacobinia carnea. (×⅛)

In their native places, jacobinias are mostly subshrubs, but they are usually treated as herbs under cultivation. They are showy greenhouse or conservatory subjects. When well grown they are attractive plants, but they soon become weedy under neglect. They propagate very readily from cuttings, after the manner of fuchsias, and the most satisfactory plants are usually those that are allowed to bloom but once. Most of them thrive well under conditions suited to begonias.

A. *Fls. in a more or less dense terminal panicle or thryse; corolla long, more or less curved.* (*Subgenera Cyrtanthera, Pachystachys.*)

cárnea, Nichols. (*Justícia cárnea*, Hook. *Cyrtanthèra magnífica*, Nees. *Justícia magnífica*, Pohl. *Jacobínia magnífica*, Benth. & Hook.). Fig. 2005. Strong forking herb or subshrub, blooming when 1 or 2 ft. high, but becoming several feet high if allowed to grow: sts. 4-angled: lvs. opposite, lanceolate to ovate-lanceolate to oval-oblong, narrow or broad at base, attenuate to apex, wavy-margined, veiny, downy, sometimes a foot long: fls. rose-purple (varying to flesh-colored), ascending, arched at the top and the lower lip recurving, borne in dense terminal spike-like thyrses. Brazil. B.M. 3383. B.R. 1397. G.F. 5:317 (reduced in Fig. 2005). G. 24:238. G.W. 3, p. 439; 15, p. 704. F.E. 22:320.—A handsome old plant, of comparatively easy cult. in a conservatory temperature. Cuttings made in Feb. or March should bloom early the following winter. Young plants are usually most satisfactory, the old ones being kept over only for cutting stock. Give rich soil, and plenty of water in the growing season. This plant is said to have been distributed as *Whitfieldia lateritia*.

Pohliàna, Benth. & Hook. (*Cyrtanthèra Pohliàna*, Nees). Much like *J. magnifica*, but more robust and leafy: lvs. ovate-acuminate and rounded or nearly or quite cordate at the base, more glabrous, often purple-tinged: fls. bright crimson: bracts short-acute, or in one form obtuse. Brazil. G. 27:677. F.S.R. 3, p. 49.

Var. velùtina, Hort. (*J. velùtina* and *Justícia velùtina*, Hort. *Cyrtanthèra Pohliàna* var. *velùtina*, Nees). Dwarf: bracts obtuse: lvs. villous-pubescent on both surfaces: fls. 2 in. long, rose-color. Brazil. Gng. 7:212; 16:24. A.F. 14:998.—A worthy plant of comparatively recent intro. in commerce. It is an excellent pot subject and has been considerably advertised as the "new dwarf *Justicia velutina*." A profuse and continuous bloomer. Cultural remarks under *J. carnea* apply also to this.

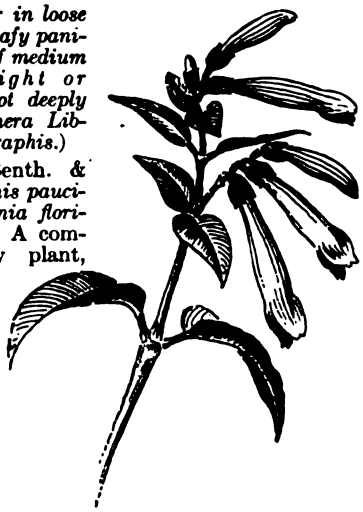
coccínea, Hiern. (*Justícia coccínea*, Aubl.). Erect herb or subshrub, usually grown from cuttings each year and treated as a pot subject: 2–5 ft. high: branches terete: lvs. elliptic or ovate-lanceolate, entire, glabrous or nearly so: fls. crimson, in a dense terminal spike, pubescent, the long upper lip more or less arched and the lower one reflexed. Brazil. B.M. 432. G.W. 15, p. 704. Gn.W. 21:57.—Blooms in summer. Said to be known sometimes as *Aphelandra cristata*.

chrysostéphana, Benth. & Hook. (*Cyrtanthèra chrysostéphana*, Hook. f.) Herbaceous, glabrous or very nearly so, obtusely 4-angled: lvs. 5–6 in. long, petioled, ovate or ovate-lanceolate, acuminate, with red ribs: fls. in an erect terminal

dense corymb, 2 in. long, golden yellow, on very short pedicels, the bracts linear-lanceolate and dark green; calyx ⅓in. long, with long subulate lobes; corolla glabrous, slightly curved, the upper lip oblong-lanceolate and vaulted, the lower lip oblong and reflexed and 3-lobed. Mex. B.M. 5887. Gn. 71, p. 563. J.H. III. 45:543. G. 27:678. G.M. 45:849. Gn.W. 21:51.—An attractive winter-flowering warmhouse subject.

AA. *Fls. scattered or in loose more or less leafy panicles; corolla of medium length, straight or nearly so, not deeply cleft. (Subgenera Libonia, Sericographis.)*

pauciflòra, Benth. & Hook. (*Sericógraphis pauciflòra,* Nees. *Libònia floribúnda,* C. Koch). A common conservatory plant, subshrubby, but usually treated as a pot-plant, with terete, short-jointed, close-pubescent branches: lvs. elliptic or elliptic-oblong, short and rather small, entire, very short-stalked: fls. 1 in. long, tubular, drooping, or nearly horizontal, scarlet with yellow at the end, the lips short. Brazil.—A most floriferous plant, almost as easy to grow as a fuchsia, and to be handled in essentially the same way.



2006. Jacobinia penrhosiensis. (×½)

Ghiesbreghtiàna, Benth. & Hook. (*Cyrtanthèra Ghiesbreghtiàna,* Decne. *Sericógraphis Ghiesbreghtiàna,* Nees. *Justícia Ghiesbreghtiàna,* Lem. *Aphelándra Ghiesbreghtiàna,* Hort.). Lvs. narrower (lance-ovate) and longer, acuminate: fls. in a terminal, very loose panicle, tubular, scarlet, appearing at the same season as those of *J. penrhosiensis.* Mex. F.S. 4:339. Gt. 98.—Intro. by Ghiesbreght; but when the plant was transferred to the genus Jacobinia the name was mispelled *Ghiesbrechtiana.* A good winter bloomer.

penrhosiénsis (*Libònia penrhosiénsis,* Carr.). Fig. 2006. Much like *J. pauciflora,* but lvs. more pointed and fls. larger and more showy. R.H. 1876:50. Gng. 2:131.—It is an excellent plant, and is taking the place of *J. pauciflora.* It is a hybrid of *J. pauciflora* and *J. Ghiesbreghtiana.* Another and very similar hybrid of the same parentage is *Sericobònia ignea,* Lindl. & André. I.H. 22:198. *J. penrhosiensis* is a winter bloomer, a little earlier than *J. pauciflora.* Cuttings struck in spring make full blooming subjects by fall and early winter. This and *J. pauciflora* are common conservatory plants.

spicígera (*Justícia spicígera,* Schlecht. *Justícia atramentària,* Benth. *Justícia Mohíntli,* Moc. & Sesse. *Sericógraphis Mohíntli,* Nees. *Jacobínia Mohíntli,* Benth. & Hook. *Drejèra Willdenowiàna,* Nees). Undershrub, erect, pubescent: lvs. long-ovate to lanceolate, thick: fls. 1 in. long, axillary, secund, orange-yellow; corolla-tube elongated, inflated above, the upper lip somewhat arched, and entire, the lower lip spiral and 3-toothed. Mex.—Fls. said by some to be pale purple.

suberécta, André. Herb, velvety pubescent: sts. prostrate, with erect flowering branches: lvs. opposite, petioled, ovate, obtuse, to 2½ in. long: fls. in 1-10-fld. peduncled cymes, the bracts spatulate-obovate and obtuse; calyx-tube short and nearly hemispheric; corolla bright scarlet, the slightly curved tube about 1¼ in. long, pubescent outside; upper lip slightly emarginate and ovate, the lower 3-toothed and oblong. Uruguay. B.M. 8350. R.H. 1900:210.—Handsome warmhouse plant, suitable for baskets.

J. Lindenii, Nichols. (Justicia Lindenii, Houll.), is a Mexican subshrub, with long-ovate opposite decussate lvs., and a dense fascicled head of orange-yellow fls.: divisions of calyx linear; corolla long-tubular, 2 in. or more; 2 stamens attached in lower part of corolla. Does not appear to be in the trade. R.H. 1870:250.

L. H. B.

JACQUEMÓNTIA (after Victor Jacquemont, a French naturalist; died 1832). *Convolvulàceæ.* Subtropical and tropical mostly climbing herbs, grown for the convolvulus-like bloom.

Allied to Ipomœa and Convolvulus, to which they are probably inferior for garden cult. They are distinguished from Ipomœa by having 2 stigmas instead of 1; and from Convolvulus by having the stigmas ovate or oblong instead of linear-filiform to subulate. Lvs. entire, or rarely toothed or lobed: fls. not large, blue, white or violet, in either dense clusters or loose racemes, sometimes even solitary; corolla more or less campanulate, the plicate limb 5-angled or obscurely 5-lobed.—Species 60–70 in Trop. Amer. and as far north as S. C., also 1 in Trop. Afr. and 1 in Hawaii.

Jacquemontia pentantha makes an attractive greenhouse climber for summer and autumn flowering, but is not so desirable for this purpose as several species of Ipomœa. It is likely to become leggy. Propagated readily by seeds or cuttings. For cultural directions, see *Ipomœa.*

pentántha, G. Don (*J. violàcea,* Choisy. *Convólvulus pentánthus,* Jacq.). St. perennial, somewhat shrubby at base, twining 6–8 ft., pubescent or nearly glabrous: lvs. cordate to ovate-lanceolate, acuminate: peduncles slender, bearing 5–12 fls. in a loose cymose cluster; corolla about 1¼ in. wide, short-funnelform, sharply 5-angled, rich violet-blue. June-Sept. Trop. Amer., and as far north as Fla. B.M. 2151. B. 4:197. P.M. 6:219. In var. **canéscens,** Hort. (*J. canéscens,* Benth.), the whole plant is covered with short, brownish down. B.R. 33:27.

tamnifòlia, Griseb. Plant annual, usually low and erect, at length twining if support is near, covered with tawny yellow hairs: lvs. cordate-ovate, long-petioled: peduncles bearing many fls. in dense involucrate clusters; fls. less than ½in. long, violet. Cult. and waste ground, S. C. to Ark., and southward.

S. W. Fletcher.
L. H. B.†

JACQUÍNIA (Nicholas Joseph de Jacquin, 1727–1817, collector and painter of West Indian plants). *Myrsinàceæ;* by some separated, with Clavija and Theophrasta, in *Theophrastàceæ.* Tropical American trees and shrubs, seldom cultivated far South for ornament.

Leaves opposite or somewhat verticillate, rigid, margined, entire: fls. white, purple or orange, borne in racemes, umbels or singly; corolla 5-fid, wheel- to salver-shaped, crowned at the throat and between the lobes with 5 roundish appendages (staminodia); stamens 5, inserted far down in corolla-tube, the filaments subulate: berry leathery, few to several-seeded. In the allied genus Theophrasta the corolla is cylindrical, shortly 5-lobed, the appendages are fastened at the base of the corolla instead of the throat, and the berry is many-seeded.—By the latest monographer (Mez, Engler's Pflanzenreich, hft. 15, 1903), 33 species are described, of the warm parts of Amer.

keyénsis, Mez (*J. armillàris,* Chapm., not Jacq.). Lvs. cuneate-spatulate or obovate, blunt, revolute at the margin, usually whorled, 4 in. long, 1½ in. wide: berry ¼in. thick. S. Fla. and Bahamas. It is a low tree (about 15 ft.), with evergreen lvs. somewhat like box but obovate, and racemes of small white honey-scented fls., which appear in winter. It appears to be

cult. only in S. Fla. and S. Calif. It is possible that the plant sometimes cult. is the *J. armillaris* of Jacquin, which Mez now calls *J. barbasco*, and which occurs in W. Indies. L. H. B.

JAMBÒSA: *Eugenia.*

JAMÈSIA (after its discoverer, Dr. Edwin James, 1797–1861, botanical explorer of the Rocky Mountains). Syn., *Edwinia. Saxifragàceæ.* Low hardy shrub of upright habit, with deciduous, opposite leaves, and white flowers in terminal, short panicles.

Leaves without stipules, petioled, serrate: calyx-lobes and petals 5; stamens 10; styles usually 3, rarely 4 or 5, slender; ovary superior, 1-celled: fr. a 3–5-valved, many-seeded, dehiscent caps.—One species in the Rocky Mts. from Utah to New Mex. Handsome shrub for borders of shrubberies or rocky slopes in sunny situations, thriving in any well-drained garden soil, best in a peaty and sandy one. Prop. by seeds or by cuttings of ripened wood.

2007. Jamesia americana. (×½)

americàna, Torr. & Gray (*Edwinia americàna*, Heller). Fig. 2007. Shrub, to 4 ft.: lvs. broadly ovate to oblong-ovate, acute, serrate, dentate, pubescent or almost glabrous above, whitish tomentose beneath, ½–2 in. long: fls. about ½in. across, white, sometimes pinkish outside. June. B.M. 6142. J.H. III. 32:37. Gn. 32, p. 522; 33, p. 606; 63, p. 105. Gt. 38, p. 103; 53, pp. 231, 232. L.I. 6. G.M. 52:85. Var. **rôsea,** Purpus. Fls. pink. ALFRED REHDER.

JÁNKÆA: *Ramondia.*

JANÙSIA (after Janus, the old Roman god with 2 faces). *Malpighiàceæ.* Twining or trailing plants, with 2 forms of yellow fls. in axillary clusters, the normal fls. having a gland-bearing calyx, a 3-angled style and 3 ovaries, and conspicuous clawed petals; abnormal fls. with an eglandular calyx, no style and 2 ovaries, and often rudimentary petals.—Ten to 15 species. **J. grácilis,** Gray, is offered in S. Calif. Sts. and branches very slender, twining or trailing: lvs. lanceolate-linear, both surfaces silky: peduncles mostly dichotomously 2-fld.; bracts linear, as long as the pedicels. Common throughout Texas, south of the Colorado, and west to New Mex. L. H. B.

JAPARÁNDIBA (probably a vernacular name). *Lecythidàceæ. Gustàvia,* which is retained by the "nomina conservanda" of the Vienna code. Upward of 20 trees and shrubs of Trop. Amer., little known in cult. Lvs. large, ovate or spatulate, alternate, serrate: fls. showy on 1-fld. somewhat umbelled peduncles; calyx-tube turbinate, the border entire or 4–6-lobed; petals 6–8, nearly equal; stamens many, in many series, annulate or cupulate; ovary 4–6-celled: fr. a fibrous few-seeded berry.—Some of the species may be found in choice collections of warmhouse plants, but only **J. speciôsa,** Kuntze (*Gustàvia speciôsa*, DC.), from Colombia, seems to be offered in this country (S. Calif.). Tree: lvs. thick, oblong-lanceolate, acuminate, narrowed at base, entire, punctulate above, reticulate beneath, about 3½ in. long: fls. fascicled, fragrant, 6-petaled, white, 2–3 in. long; calyx nearly entire and with the pedicel tomentose. Colombia.

J. gracillima, Niedz. (Gustavia gracillima, Miers). Slender tree, glabrous: fls. 4 in. diam., rose-red, solitary or in pairs, from the lf.-axils on young plants and on the wood in old plants: lvs. close together, recurved, to 18 in. long, oblanceolate or much narrower, serrate. Colombia. B.M. 6151. G.Z. 21, p. 49.—*J. pterocárpa,* Niedz. (G. pterocarpa, Poit.). Fls. with 6 large obtuse white petals; calyx deeply 5–6-lobed; ovary 5-winged: lvs. thick, long-petioled, obovate-lanceolate, entire or very nearly so, acuminate: style elongated. Guiana. B.M. 5239.—*J. supérba,* Kuntze (G. superba, Berg. G. insignis, Lind.). Shrub or small tree: corolla 5–6 in. diam., cream-white, outside tinged rose: lvs. dark green and glossy, obovate-lanceolate, acuminate, much attentuate at base, sessile or nearly so, spinulose-toothed. B.M. 5069. L. H. B.

JASIÒNE (ancient name of no application to this plant). *Campanulàceæ.* Small blue-flowered or rarely white-flowered plants for the border or the rock-garden.

Jasione is easily distinguished from its allies by the fls. being borne in a head with an involucre, the calyx reduced to 5 very slender lobes, the corolla cut into 5 awl-shaped strips, and the anthers somewhat united at their bases; these characters make the infl. to resemble the Compositæ, but it is readily distinguished by the many-seeded caps.—Species 5 or 6, in Cent. and W. Eu. and the Medit. region. They differ widely in duration and habit. Prop. by division and seed. This includes the shepherd's scabious, a hardy herbaceous perennial plant of compact habit, about a foot high, and bearing globose heads 2 in. diam. composed of very many light blue fls. It is of easy cult. in any garden soil, grows either in full sunlight or partial shade, and is equally adapted for borders, edgings, or the rockery. The common annual scabious (Scabiosa) belongs to the teasel family, and has 4 stamens, while the shepherd's scabious has 5 stamens.

perénnis, Lam. SHEPHERD'S SCABIOUS. SHEEP SCABIOUS. SHEEP'S-BIT. Perennial: st. erect, sparingly if at all branched: root-lvs. obovate, in the non-floriferous plants forming a tufted rosette; st.-lvs. oblong-linear, entire; peduncles long, leafless; bracts ovate, serrate-dentate; fls. blue. S. Eu. July, Aug. B.R. 505. B.M. 2198.

montàna, Linn. Annual or biennial (if biennial, bearing a winter tuft or rosette of radical lvs.): sts. erect, 1 ft. high, sometimes short and more or less decumbent: lvs. linear or lanceolate, undulate, somewhat hairy: fls. pale blue, on long terminal peduncles; involucral bracts ovate. Great Britain to Caucasus.—The seaside form, (var. *littorâlis*) is said to be usually biennial. This species is also called sheep's-bit.

hûmilis, Lois. Dwarf, about 6–9 in. high, perennial: sts. simple, ascending: lvs. flat and entire, linear-obovate: fls. blue on short peduncles. Pyrenees; useful in rock-gardens. July, Aug. L. H. B.†

JÁSMINUM (Arabic name, from which have come Jessamine, Jasmin and Jasminum). *Oleàceæ.* JASMINE. JESSAMINE. Climbing or erect shrubs, with attractive flowers, mostly very fragrant, prized for planting in mild climates and frequently grown under glass.

Leaves opposite or alternate, pinnate but sometimes reduced to 1 lft. (petiole jointed): fls. on the ends of the branchlets, or twin, or in dichotomous cymes; corolla yellow or white, sometimes reddish, salver-shaped, the 4–9 or more lobes convolute in the bud, much exceeding the calyx; stamens 2, included in the corolla-tube; ovary 2-loculed, with 1–4 erect ovules: fr. a 2-lobed berry, or sometimes the carpels separate, the carpels mostly 2-seeded.—Probably upwards of 200 species, widely distributed in warm parts of Eu., Asia, Afr., and the Pacific region; nearly absent from Amer. The genus is closely allied to Ligustrum, but differs in the compound lvs. and twin-carpeled frs. Olea is also a related genus.

LX. Juglans nigra.—The black walnut.

Jasmines are of diverse horticultural groups. Some of them are hardy in the middle and southern states, whereas others are winter-flowering warmhouse plants. Most of them are known as coolhouse or temperate-house shrubs, of half-climbing habit. They are all of easy culture. They propagate readily by cuttings of nearly mature wood and by layers. The species are usually called jasmines although the word jessamine is really the same. *J. officinale* is the jessamine of poetry. Some of them (particularly *J. grandiflorum*) are grown for perfume-making. The Cape jessamine is Gardenia, although there is a *Jasminum capense*. Yellow or Carolina jessamine is Gelsemium. The hardiest kinds are *J. humile, J. fruticans, J. floridum, J. nudiflorum, J. primulinum, J. officinale*, but none of them is reliable north of Washington without protection, and even then only seldom north of Philadelphia.

INDEX.

affine, 13.
anastomosans, 2.
angulare, 15.
aureum, 17.
azoricum, 12.
Beesianum, 11.
capense, 15.
flavum, 20.
floribundum, 14.
floridum, 23.
fruticans, 19.
glabratum, 15.
gracile, 1.
gracillimum, 8.
grandiflorum, 16.
hirsutum, 7.
humile, 20.
ligustrifolium, 3.
lucidum, 1.
luteum, 19.
Maingayi, 10.
multiflorum, 7.
multipartitum, 4.
nitidum, 9.
nudiflorum, 17.
odoratissimum, 22.
officinale, 13.
poeticum, 13.
primulinum, 18.
pubescens, 7.
pubigerum, 21.
Reevesii, 20.
revolutum, 20.
rigidum, 3.
Sambac, 5.
Sieboldianum, 17.
simplicifolium, 1.
subulatum, 23.
syriacum, 19.
trifoliatum, 5.
trinerve, 2.
triumphans, 20.
undulatum, 6.
Wallichianum, 20.

A. *Lvs. apparently simple (reduced to 1 lft.).*

B. *Fls. white.*

C. *Calyx glabrous (No. 4 not considered).*

1. **simplicifòlium,** Forst. (*J. lùcidum*, Banks. *J. grácile*, Andr.). Climber, or sometimes a tree in its native place, glabrous or pubescent: lvs. opposite, mostly short-stalked, shining, varying from oblong-elliptic to ovate-lanceolate to cordate-ovate, acute or obtuse, usually less than 3 in. long: fls. white, in terminal forking, many-fld. clusters; calyx-teeth short and sometimes scarcely any; corolla-tube ⅛–½in. long, the acute lobes somewhat shorter. Austral. B.M. 980. B.R. 606.—Summer bloomer.

2. **trinérve,** Vahl. Tall-climbing, with terete glabrous branches: lvs. opposite, short-stalked, ample, ovate-oblong and acuminate, strongly 3-nerved from the base: fls. white, in small clusters; calyx-teeth narrow but much shorter than the long corolla-tube; corolla-lobes only half as long as the tube, acute. India. B.R. 918.—Perhaps only a form of *J. anastomosans*, Wall.

3. **rígidum,** Zenker (*J. ligustrifòlium*, Wall.). Compact dense rigid glabrous shrub, scarcely climbing: lvs. opposite, 2 in. long, ovate or elliptic, shining green, more or less acute at both ends but not acuminate, coriaceous, with reticulating nerves: fls. white, fragrant, in few-fld. dense sessile cymes; calyx-teeth linear, erect; corolla-tube 1 in. long, exceeding the lobes. India.

4. **multipartìtum,** Hochst. Erect bushy shrub, to 10 ft., the branches minutely puberulent: lvs. simple, ovate-lanceolate, less than 2 in. long, acute, somewhat undulate: fls. probably white, fragrant, solitary on the ends of branches; calyx 10-parted, the lobes setaceous; corolla-tube to 1½ in. long, the limb of several or many ovate-elliptic or linear-oblong acute lobes. S. Afr.

CC. *Calyx pubescent or pilose.*

D. *Teeth of calyx subulate.*

5. **Sámbac,** Soland. ARABIAN JASMINE. Climbing, the angular branchlets pubescent: lvs. opposite or in 3's (the ternate-lvd. specimens giving rise to the name *J. trifoliàtum*, Hort.), firm in texture, shining, nearly or quite glabrous, the petiole short and abruptly curved upward, elliptic-ovate or broad-ovate, either prominently acute or completely rounded on the end, entire, prominently veined: clusters 3–12-fld.; calyx-lobes linear and prominent, hirsute on the edges (sometimes almost glabrous); corolla-tube ½in. long; lobes oblong or orbicular. India. B.R. 1.—Much cult. in the tropics. Fls. white, but turning purple as they die. A full double button-fld. group is in cult., one form of which is the Grand Duke of Tuscany (or Grand Duke). The double form is shown in B.M. 1785. This double form sometimes passes as *J. trifoliatum*. *J. Sambac* is a perpetual bloomer, particularly in frostless countries, where it can stand in the open.

6. **undulàtum,** Ker. Climbing, with hairy branches, slender: lvs. opposite, short-petioled, rather small (about 2 in. long), ovate-lanceolate and acuminate, somewhat pubescent beneath, somewhat undulate: fls. 6–10, in terminal cymes, white, long-tubed; calyx-teeth short; corolla-tube ¾in. long, and slender; lobes half or less as long, acute. India. B.R. 436.—Lvs. sometimes ternate. Little known in cult. in this country.

7. **pubéscens,** Willd. (*J. hirsùtum*, Willd. *J. multiflòrum*, Andr.). Climbing, rusty-hairy: lvs. opposite, very short-petioled, rather thick, ovate-acute: calyx-teeth usually ⅜in. long (nearly or quite twice as long as in *J. undulatum*), with spreading yellow hairs: fls. white, much like those of *J. undulatum*, the lobes broad; often half-double. India. B.M. 1991. B.R. 15. J.H. III. 43:322.—Will stand some frost. Said to be a good dwarf glasshouse subject.

8. **gracíllimum,** Hook. f. Climbing or scrambling, soft-pubescent or hairy: lvs. opposite, very short-petioled, ovate-lanceolate, acuminate, the base cordate or truncate, bright green above and pubescent beneath, 1½ in. or less long: fls. white, in very large, dense hanging heads, an inch or more across, fragrant; calyx-teeth long and awl-like, half as long as the slender corolla-tube; corolla-lobes many (usually about 9), acute. N. Borneo. G.C. II. 15:9. B.M. 6559. J.H. III. 52:281. G.Z. 26, p. 97. G. 4:471; 7:233. F.S.R. 3, p. 15.—Long, lithe branches spring from near the ground and bear heavy clusters at their ends. Handsome floriferous winter bloomer. Nearly hardy in eastern part of N. C.

DD. *Teeth of calyx linear.*

9. **nítidum,** Skan. Slender-branched, somewhat pubescent, half-twining: lvs. opposite, shining, 2–3 in. long, elliptic-lanceolate, short-acuminate, the base somewhat cuneate, green above and pale beneath, lightly pilose along the rib, primary veins 3, the petiole less than ¼in. long and very pilose: fls. white, in small cymes, very fragrant, the pedicels about ⅓in. long; calyx pilose, the teeth linear and recurved and about ⅙in. long; corolla-tube narrow, ¾in. long; lobes of corolla 9–12, linear-lanceolate, spreading, 1½ in. broad. Admiralty Isls. (Bismarck Archipelago). R.B. 32, p. 182. R.H. 1907, pp. 110, 111. J.H. III. 60:237. Gn. 63, p. 61. A.F. 15:1237.—An excellent warmhouse climber.

10. **Màingayi,** Clarke. Scandent shrub with pilose branches: lvs. opposite, long-petioled, elliptic-lanceolate, 5 in. long, glabrous, acute at apex and rhomboid at base, coriaceous, the nerves 6–8 pairs and conspicuous and oblique and not inarched: fls. white, star-shaped, fragrant, in dense pubescent panicled cymes, on very short pedicels; calyx-tube ⅓in. long, campanulate, the teeth ⅓in. or less long, linear; corolla-tube ¾–1 in. long. the elliptic lobes acute, the limb 1½ in. diam. Penang (India). B.M. 7823.—Named for Dr. A. C. Maingay, the discoverer.

BB. *Fls. pink or red.*

11. **Beesiànum,** Forrest & Diels. Shrub, 1–3 ft.: lvs. simple and small, short-petioled, ovate or lanceolate,

1 in. or less long: fls. pink or deep rose, very fragrant; calyx-lobes linear, less than ¼in. long; corolla-tube short (less than ½in. long); lobes of corolla erect or spreading, broad-elliptic or suborbicular, short. W. China, altitude 8,000–9,000 ft. (Bees, Ltd., Liverpool.)

AA. *Lvs. of 3 or more lfts.* (*sometimes only 1 in No. 19*).

B. *The lvs. opposite.*

C. *Fls. white.*

12. **azòricum,** Linn. Climbing, glabrous or nearly so, the branches terete: lvs. evergreen, opposite, the lfts. 3, ovate-acuminate, the 2 side ones often smaller: calyx-teeth very small; oblong corolla-lobes about as long as the tube. Canary Isls. B.M. 1889.—A good white-fld. temperate-house species blooming in summer and winter.

13. **officinàle,** Linn. (*J. poéticum,* Hort.). JESSAMINE. Fig. 2008. Long, slender grower requiring support, but scarcely self-climbing, glabrous or very nearly so: lvs. opposite, odd-pinnate, the lateral lfts. 2–3 pairs and rhomboid-oblong-acute, the terminal one longer: fls. white, 2–10 in terminal more or less leafy clusters; calyx-teeth linear, ¼–⅔in. long, or sometimes as long as the rather short corolla-tube; corolla-lobes 4 or 5, oblong, more or less involute on the margins. Kashmir, 3,000–9,000 ft., Persia, and now widely distributed. B.M. 31. R.H. 1878, p. 428.—Long cult. The glossy foliage and

2008. Jasminum officinale. (×½)

fragrant white summer-blooming fls. render the plant very attractive in the S., where it is hardy. With protection it will stand as far N. as Philadelphia. Var. **affine,** Nichols. (*J. affine,* Hort.), is a form with larger fls. R.H. 1878, p. 428. There are double-fld. forms; also with yellow- and silver-edged lvs.

14. **floribúndum,** R. Br. Much like *J. officinale,* but differs in calyx-teeth, and corolla-lobes wider and more obtuse and only half length of the tube: branches glabrous: lvs. opposite; lfts. 5, ovate, apiculate, the terminal one largest: fls. fragrant, white, in dichotomous axillary and terminal clusters; calyx-lobes subulate, longer than the bell-shaped calyx-tube; corolla-tube exceeding the calyx, to ¾in. long; segms. 5, ½in. long, oblong. Nile Land.

15. **angulàre,** Vahl. Climber with long 4-angled branches: lvs. opposite, hirsute; lfts. 3, orbicular, ovate to lanceolate, mucronate: fls. white, about 1½in. across, odorless, in 3's on axillary trifid peduncles; calyx glabrous, 5-toothed, the teeth equaling or shorter than the tube; corolla-tube many times longer than calyx, 1–1½ in., very slender; lobes of corolla 5–7, oval-lanceolate, somewhat obtuse or subacute. S. Afr. B.M. 6865. G.C. III. 28:360, 361. Var. **glabràtum,** Mey. (*J. capénse,* Thunb.). St. scarcely puberulent, the lvs. glabrous.

16. **grandiflòrum,** Linn. CATALONIAN, ITALIAN, ROYAL or SPANISH JASMINE. Nearly erect-growing, the branches drooping and angular, glabrous or very nearly so: lvs. opposite, the rachis flattened or winged, the lfts. 5–7, elliptic or round-elliptic or oval, mostly ending in a very small point or cusp, the terminal lft. mostly ovate-lanceolate and acuminate: calyx-teeth ¼in. long or rarely half as long as the corolla-tube; corolla star-shaped, larger than in *J. officinale.* India; naturalized in Fla. B.R. 91. G. 2:451.—Probably the best white-fld. species. Summer and fall, or nearly perpetual in warm countries. Much grown in Eu. for perfumery, and also a good greenhouse subject; young stock may be planted out in spring; will stand sun. Stands 10–12° of frost.

CC. *Fls. yellow.*

17. **nudiflòrum,** Lindl. (*J. Sieboldiànum,* Blume). Twiggy nearly erect shrub with 4-angled glabrous stiff branchlets: lvs. opposite, small, with 3 little ovate ciliate lfts., the entire foliage falling in autumn or when the growth is completed: fls. solitary, in early spring (or winter), from long, scaly buds, subtended by several or many small lf.-like bracts, yellow; calyx-lobes leafy and spreading or reflexed, shorter than the corolla-tube; corolla-segms. obovate, often wavy. China. B.R. 32:48. B.M. 4649. R.H. 1852:201. G.C. III. 11:181. G.W. 15, p. 300. H.F. 2:64. J.F. 3:320. Var. **aùreum,** Hort., has yellow-variegated foliage.—A most interesting species, reminding one of forsythia when in bloom. Hardy south of Washington, and blooming nearly all winter. With protection, it will stand as far north as Hudson River valley, and bloom very early in spring. In northern glasshouses, used mostly as a late winter and early spring bloomer. Strong-growing specimens need support.

18. **primùlinum,** Hemsl. Very like *J. nudiflorum,* botanically, but with larger lvs. which are sometimes well developed at flowering-time, and with much larger fls., the limb of the corolla exceeding the tube; a rambling very free-flowering evergreen glabrous shrub, with slender green 4-angled branches: lvs. petioled, of 3 lfts. which are almost sessile and 1 or 2 in. long, entire, oblong-lanceolate, shining above and paler beneath: fls. primrose-yellow with a darker eye, 1½–2 in. across, solitary on axillary bracted peduncles or branchlets; calyx-lobes lanceolate, slightly hairy; corolla-lobes usually 6, obovate-spatulate; stamens exserted. Yunnan, China, apparently as an escape from cult.; sometimes partially double. B.M. 7981. G.C. III. 33:197. R.H. 1904, p. 182; 1906:472. R.B. 35, p. 266. Gn. 69, p. 71; 71:270. J.H. III. 46:295. G.M. 46:163; 49:141. F.S.R. 2:168.—One of the best introductions of recent years; stands some frost. It blooms in early spring, the season lasting two months or more. Not hardy north of Washington, but nearly evergreen in the S.

BB. *The lvs. alternate: fls. yellow.*

19. **frùticans,** Linn. (*J. lùteum,* Gueld. *J. syrìacum,* Boiss. & Gaill.). Glabrous bush, to 12 ft., not climbing,

but with slender and weak branches which are angled: lvs. alternate; lfts. 3 (rarely 1), somewhat curved, obovate to spatulate or oblong, obtuse: fls. yellow, not fragrant, few in subterminal clusters; calyx-lobes subulate; corolla-tube twice length of calyx, about ½in. long; lobes of corolla 5, obtuse: berries black at maturity. S. Eu., N. Afr. B.M. 461.—Evergreen.

20. **húmile,** Linn. (*J. revolùtum*, Sims. *J. Wallichiànum* Lindl. *J. flàvum*, Sieb. *J. triúmphans*, Hort.). Fig. 2009. A diffuse shrub, in the open ground

2009. Jasminum humile. (×⅓)

in the S. reaching 20 ft. and requiring support, but in glasshouses usually grown as a pot-bush: branches glabrous, angled: lvs. alternate, odd-pinnate (rarely reduced to 1 lft.), the lateral lfts. 1–3 pairs, all lfts. thickish and acuminate, and more or less revolute on the edges, varying from oblong to oblong-lanceolate to oblong-rotund: fls. bright yellow, in open clusters; calyx-teeth very short; corolla-tube ¾–1 in. long, usually considerably exceeding the mostly obtuse and reflexing lobes. Trop. Asia. B.M. 1731. B.R. 178; 350; 1409. L.B.C. 10:966.—Apparently the commonest jasmine in American glasshouses, usually known as *J. revolutum*. It is hardy in the open as far north as Maryland. Lvs. thick and evergreen. Needs a cool house if grown under glass. Summer and fall bloomer. *J. Reèvesii*, Hort., probably belongs to this species. Some horticulturists distinguish a *J. humile* from *J. revolutum*, the former said to be of smaller size, less floriferous, and fls. smaller and scarcely fragrant.

21. **pubígerum,** D. Don. Erect shrub, much like *J. humile* and perhaps a form of it, but softly and densely villous: lvs. alternate; lfts. 3–7, to 2 in. long, suborbicular to ovate or oblong, villous on both surfaces: fls. yellow, in dense nearly sessile, very villous, about 15-fld. cymes; calyx-teeth linear, longer than in *J. humile;* corolla-tube ⅜in. long. India.

22. **odoratíssimum,** Linn. Much like No. 20, but more erect and less leafy when in flower: lvs. alternate, the lfts. 3 or 5, shining, oval or broad-oval and obtuse: fls. yellow, in a terminal cluster; calyx-teeth very short; corolla-lobes oblong-obtuse, mostly shorter than the tube. Summer. Madeira. B.M. 285.—It is an erect, glabrous shrub with straight, stiff, terete or slightly angular branches.

23. **flóridum,** Bunge (*J. subulàtum*, Lindl.). Shrub, glabrous, erect but with flexuous branches: lvs. alternate, 3-foliolate (rarely 5-foliolate), the lfts. coriaceous, ovate-oblong or oval and acute: fls. golden yellow, ½in. diam. in open cymes or panicles; calyx-teeth long-subulate, as long as the tube, the calyx-tube turbinate and 5-angled; corolla-tube 4 times length of calyx; segms. ovate, acute, spreading to 1¾ in. across; stamens included. China. B.M. 6719.—Hardy as far north as Washington. Apparently very little planted.

J. auriculàtum, Vahl. Scandent, pubescent or nearly glabrous: lvs. mostly simple but sometimes 3-foliolate and the lateral lfts. reduced to auricles: fls. white, in compound many-fld. cymes; corolla-tube ½in. or less long, the lobes elliptic and ¼in. long. India. B.R. 264.—*J. calcàreum*, Muell., is a spring- and summer-blooming Australian twining quite glabrous species with white fls. and simple, opposite, thick, 3- or 5-nerved lvs.—*J. dídymum*, Forst. Climber: fls. small, white, in narrow axillary cymes which exceed the lvs.: lvs. opposite, ternate; lfts. often retuse. Austral. B.M. 6349. Said to be an excellent warmhouse species.—*J. Gìrdlii*, Diels. Branches angled, hairy: lvs. alternate, 3–5-foliolate; lfts. lanceolate, somewhat obtuse or apiculate, the terminal one longer: corymb terminal, about 3–5-fld.; calyx-segms. subulate, hispid; corolla yellow, the tube 6–8 times longer than calyx, the lobes apiculate. China. Allied to J. humile and J. pubigerum.—*J. paniculàtum*, Roxbg. Evergreen climber, suitable for warmhouse: lvs. opposite, 3 foliolate; lfts. elliptic, obtuse: fls. white, in cymes; corolla-tube ½in. long. China. B.R. 690. L.B.C. 5: 469.—*J. polyánthum*, Franch., a Chinese species in the way of J. grandiflorum, may be expected to appear in cult. in greenhouses. Fls. white inside, reddish outside, long-tubed, very fragrant: lvs. opposite, with about 5 long-acuminate lfts: sts. long and sarmentose. R.H. 1891, p. 270.

L. H. B.

JATEORHÌZA (name alludes to healing qualities of the root). Also spelled *Jatrorrhiza*. *Menispermàceæ*. Tropical twiners.

Herbaceous perennials or suffrutescent, with rough or setose sts.: lvs. large, palmately lobed: dicœcious; male fls. in long and slender racemose panicles in the axils; female fls. in racemes that are simple or nearly so; sepals 6 in 2 series; petals 6, shorter than the sepals; stamens (in male fl.) 6, the filaments free or connate; carpels (in female fl.) 3, with divided stigmas: fr. an ovoid drupe.—Species apparently 2, in Trop. Afr. *J. palmàta*, Miers (*Cócculus palmàtus*, DC. *Menispérmum palmàtum*, Lam. *M. Colúmba*, Roxbg. *J. Colúmba*, Miers). Probably not in the trade in our territory, but the fascicled fusiform fleshy roots are the source of the drug calumba: st. herbaceous: lvs. 6–16 in. across, 3–5-lobed, deeply cordate, the lateral lobes broad-ovate or roundish triangular, the central lobe often broadly obovate: male panicles very slender, 6–12 in. or more long: drupes ovoid, setose, in clusters of 4–6. Mozambique; the name calumba or columba is said to have come from Columbo, Ceylon, whence the supply of roots was once supposed to have come. B.M. 2970, 2971.

L. H. B.

JÁTROPHA (Greek, referring to its medicinal use). *Euphorbiàceæ*. A varied group of tropical herbs, shrubs or trees; several species cultivated in the greenhouse for their ornamental or curious leaves and flowers; and some grown in the tropics for their economic uses.

Juice milky: lvs. alternate, simple, usually palmately lobed, sometimes pinnate and entire: fls. monœcious, rarely dicœcious, usually with petals; sepals 5, more or less connate at base, imbricate; stamens about 10, in 2 or more whorls, some, at least, with the filaments connate; ovary 2–5-celled, 1 ovule in each cell: fr. a caps.—About 150 species, chiefly in the tropics of Amer. and Afr. Related to Hevea and Aleurites.

Most of the species of Jatropha are tropical shrubs, but several low or herbaceous species extend into the southern United States. One, the spurge nettle, *J. stimulosa*, Michx. (*Cnidoscolus stimulosus*, Gray), is a stinging weed of sandy soil in the South, with white tubular calyx. A related species *J. aconitifolia*, is planted for hedges in Central America. Many species have found use in medicine chiefly as local or popular remedies. The oil of *J. Curcas*, for which the plant is cultivated in tropical America, is used as a purgative and also for cooking, soap-making and the like. In Mexico the seeds are reported to be eaten like peanuts. A few years ago *J. gossypifolia* attracted some attention as a remedy for leprosy.

Most of the species are adapted to sandy loam soil. They grow readily from seeds, and cuttings from hard young branches can be rooted in sand with bottom heat if dried somewhat before bedding.

A. *Petals free, or nearly so: lvs. long-petioled; stipules usually dissected and persistent.*

gossypifólia, Linn. BELLYACHE BUSH. Subshrub, 2–6 ft. high: lvs. 5-lobed, nearly glabrous, 4–6 in. wide,

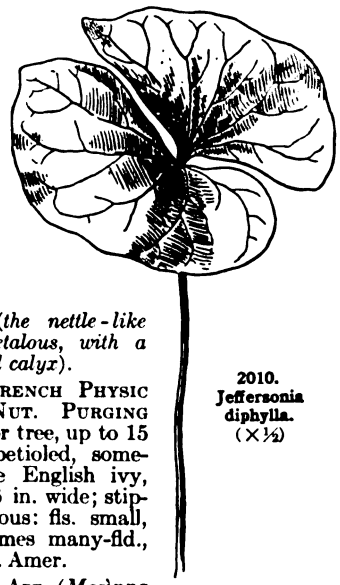
with prominent gland-tipped hairs on the margin, stipules and petioles, those of the latter branched: petals dark purple; ovary pubescent: fr. globular-oblong, warty. Trop. Amer., Key West; Trop. Afr. L.B.C. 2:117. B.R. 746.

glandulífera, Roxbg. (*J. glaùca*, Vahl). Shrub, 3–4 ft. high: lvs. 3–5-lobed, almost glabrous, glaucous, glandular dentate; stipules nearly 1 in. long; petiole not glandular: fls. yellowish green; ovary glabrous. India.

multífida, Linn. CORAL PLANT. PHYSIC NUT. Shrub, 5–15 ft. high: lvs. deeply palmately 7–11-parted, glabrous, glaucous below, the lobes narrow, 4–7 in. long, pinnately incised to entire; stipules about ½in. long; petiole not glandular: fls. scarlet. Texas to Brazil.

podágrica, Hook. GUATEMALA RHUBARB. PHYSIC NUT. TARTAGO. Shrub, 1–2 ft. high: lvs. peltate, 3–5-lobed, 4–8 in. wide, glabrous and glaucous, lobes entire; stipules about ¼in. long; petiole not glandular: petals scarlet; ovary glabrous. Cent. Amer. H.F. 8:146. B.M. 4376.

pandurifòlia, Andr. (*J. acuminàta*, Desv. *J. hastàta*, Griseb. *Mánihot diversifòlia*, Sweet). Large shrub: lvs. ovate to oblong or panduriform, entire except the dentate base, 2–3 in. wide, glabrous or puberulent; petiole 2 in. or less long; stipules small, entire, not glandular: petals over ½in. long, scarlet; cyme many-fld. W. Indies. B.M. 604. L. B. C. 17: 1604.



2010. Jeffersonia diphylla. (×½)

AA. *Petals united (the nettle-like species are apetalous, with a tubular petaloid calyx).*

Cúrcas, Linn. FRENCH PHYSIC NUT. BARBADOS NUT. PURGING NUT. Large shrub or tree, up to 15 ft. high: lvs. long-petioled, somewhat 3–5-lobed like English ivy, almost glabrous, 3–6 in. wide; stipules minute; deciduous: fls. small, yellowish green; cymes many-fld., corymbiform. Trop. Amer.

spathulàta, Muell. Arg. (*Mozìnna spathulàta*, Ort.). TOCOTE PRIETO. Shrub, 1–15 ft. high, stoloniferous: branches fleshy: lvs. sessile, nearly glabrous, spatulate, entire or 3-lobed: fls. in fascicles, diœcious, pale rose-color; ovary 1–3-celled: caps. usually 1-seeded. Texas to Cent. Amer.—Sometimes seen in succulent collections.

J. aconitifòlia, Mill., var. *Papàya*, Pax. Tree, apetalous, stinging, spiny. Cent. Amer.—*J. canéscens*, Muell. Arg. Shrub: petals united. Calif. to Cent. Amer.—*J. frágrans*, HBK. Tree, stinging, spiny, apetalous: fls. aromatic. Cuba.—*J. integérrima*, Jacq.= J. diversifolia, Muell. Arg. Small tree or shrub: petals free, stipules entire; fls. red. B.M. 1464. W. Indies.—*J. Kunthiàna*, Muell. Arg. Shrub, apetalous, stinging, spiny. Trop. Amer.—*J. Mánihot*= Manihot.—*J. Pohliàna*, Muell. Arg. Shrub or small tree: petals free: stipules dissected. S. Brazil.—*J. úrens*, Linn. Shrub, stinging, spiny, apetalous. G.C. II. 14:753. Trop. Amer.

J. B. S. NORTON.

JEFFERSÒNIA (Thomas Jefferson, third president of the United States). *Berberidàceæ*. Attractive hardy perennial herbs.

Rhizomatous: lvs. radical, palmately nerved, 2-lobed or 2-parted: fl. solitary on a naked scape; sepals 4, petaloid but fugacious; petals 8, flat, larger than sepals; stamens 8, free, with slender filaments; ovary single, the style 2-lobed at apex: fr. a caps., partially circumscissile near summit.—Two species, 1 in E. N. Amer. and 1 in Manchuria. The oriental species, *J. dubia*, Benth. & Hook., seems not to be in cult.

diphýlla, Pers. (*Podophýllum diphýllum*, Linn. *J. binàta*, Bart.). Fig. 2010. TWIN-LEAF. RHEUMATISM-ROOT. Lvs. glaucous beneath, 3–6 in. long, 2–4 in. wide, the petioles 6–12 in. high: fls. about 1 in. across, white. N. Y. and Ont. to Wis. and Iowa, and to Tenn. G. 35:113.—A very attractive woods plant. Sometimes has parts of fls. in 3's or 5's.

L. H. B.

JERUSALEM ARTICHOKE: *Artichoke, Jerusalem.* **J. Cherry:** *Solanum Pseudo-capsicum.* **J. Cross:** *Lychnis chalcedonica.* **J. Oak:** *Chenopodium Botrys.* **J. Sage:** *Phlomis fruticosa.* **J. Thorn:** *Parkinsonia aculeata.*

JESSAMINE: *Jasminum officinale* and others. **Cape J.:** *Gardenia jasminoides.* **Malayan J.:** *Rhyncospermum jasminoides.*

JEWEL WEED: *Impatiens aurea* and *I. biflora.*

JIMPSON or **JIMSON WEED:** *Datura.*

JOANNÈSIA (from Johannes). *Euphorbiàceæ*. A tree cult. in many tropical lands for ornament, for the wood, and the seeds used in medicine. Juice milky: lvs. alternate, long-petioled, digitately 3–7-foliate; lfts. stalked, entire: fls. monœcious, with petals; calyx 5-toothed, valvate; stamens 7–10, more or less united; ovary 2-celled, ovules 1 to each cell: fr. a large drupe.—One species, related to Aleurites and Jatropha. It grows easily on poor soil and stands long droughts well. It is hardy in S. Calif.

princeps, Vell. (*Ánda Gomèsii*, Juss.). ANDA ASSU and various other native names. A large tree: lfts. ovate, 3–4 in. long: infl. a paniculate cyme, terminal and axillary; fls. inconspicuous: fr. 4–5 in. thick, coconut-like, with 4 large oily seeds. S. Brazil.

J. B. S. NORTON.

JOB'S TEARS: *Coix Lacryma-Jobi.*

JOE-PYE WEED: *Eupatorium purpureum.*

JOHNSON-GRASS: *Holcus halepensis.*

JONQUIL: *Narcissus.*

JOVELLÀNA (*Jovellanos*, Spanish personal name). *Scrophulariàceæ*. A half-dozen South American and New Zealand plants that sometimes are included with Calceolaria, are referred to this genus. None of them is apparently in cultivation in this country, but *J. violàcea*, Don (see *Calceolaria violacea*, supplementary list) is sometimes cultivated as a greenhouse plant in the Old World. They differ from Calceolaria in having a ringent corolla without a saccate lip.

JUANULLÒA (George Juan and Antonio Ulloa, Spanish naturalists who traveled in Chile and Peru). *Solandceæ*. About 10 species of shrubby plants, more or less epiphytic, from Cent. Amer. to Peru, sometimes mentioned in horticultural literature as suitable for growing in the warmhouse. Erect or diffuse and producing runners or decumbent branches, glabrous or tomentose: lvs. thick and entire: fls. yellow or red, solitary or in clusters; calyx colored, large; corolla tubular, sometimes ventricose and contracted at the throat, with small broad lobes; stamens inserted in lower part of corolla-tube: fr. an indehiscent succulent or dry berry. *J. aurantìaca*, Otto & Dietr. (*J. parasítica*, Hook.), is the species most likely to occur in cult. It is a glabrous shrub with herbaceous young branches: lvs. alternate, sometimes 2 together and very unequal, 2–5 in. long, oval or obovate, obtuse, short-petioled: fls. terminal on drooping branches in a sort of leafy raceme, showy, orange; calyx fleshy and large, 5-angled, loose on the corolla, the latter about a third longer and tubular, enlarging upward, and with a limb of 5 short rounded segms. Peru, where it is said to be epiphytic; but said to thrive well in a warmhouse in earth. B.M. 4118. H.U. 2, p. 321.

L. H. B.

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JUBÆA (after Juba, king of Numidia). *Palmàceæ.* The wine palm of Chile, *J. spectabilis*, which in this country is cultivated outdoors in southern California and in the North under glass.

Jubæa has only 1 species, a tall, unarmed S. American palm: caudex thick, covered with the bases of the sheaths: lvs. terminal, pinnatisect; segms. spreading, linear-lanceolate, rigid; margins recurved; rachis laterally compressed, convex on the back, acute beneath; sheath short, open. Allied genera in cult. are Attalea, Cocos, Maximiliana and Scheelea, which are distinguished chiefly by the staminate fls. In Jubæa the petals are lanceolate; stamens numerous, included, the anther-cells connate: fr. 1-seeded. In Attalea the petals are lanceolate; stamens 10–24, included, anther-cells connate: fr. 2–6-seeded. For distinctions from other genera consult also *Cocos*, *Maximiliana* and *Scheelea*.

Jubæa spectabilis is a handsome and satisfactory palm for the cool palm-house, where it would be treated in common with such plants as *Chamærops humilis*, the sabals and *Euterpe montana*, which may be grown well in a night temperature of 50°, providing the plants are properly established. In general appearance, *J. spectabilis* reminds one of some kinds of Phœnix, and, like them, does not show the true character of its foliage in a very small state, the seedling jubea producing several simple leaves before developing foliage of the pinnate type. In Jubæa, however, the lower pinnæ do not revert to spines, as is usually the case with Phœnix and the pinnæ are also arranged irregularly on the midrib, thus giving the fronds a feathery effect. The culture of jubea is by no means difficult, propagation being effected by means of imported seeds, which usually give a fair percentage of germination, providing they are started in a warmhouse and kept moist. The seedlings should be potted as soon as the second leaf appears, and kept in a warmhouse until they are large enough for a 4-inch pot, and from this time forward cooler treatment will give the best results, always remembering the fact that while many palms (and jubea among the number) will bear much neglect, yet the best results are to be had only by giving plenty of nourishment. (W. H. Taplin.)

spectábilis, HBK. Height 40–60 ft. but much lower in cult.: lvs. 6–12 ft. long. G.C. II. 18:401; III. 18:516. Gn. 5, p. 413. V. 8:340. A.F. 22:696. C.L.A. 2:19. Gng. 12:658.—The southernmost American palm. "It is one of the hardiest palms," says Franceschi, "and can endure drought and many degrees of cold. If liberally treated, it makes a large tree in a few years." A full-sized trunk yields about 90 gallons of sugary sap, which is boiled by the Chileans and called "Miel de Palma" or palm honey, which is extensively used on ships and hotels on the west coast of S. Amer. There is some danger of the species being exterminated in Chile. The frs. look like diminutive coconuts, and are called Coquitos, or by the trade "monkey's coconuts." In Europe, it is cult. under glass, and also used for subtropical bedding. N. Taylor.†

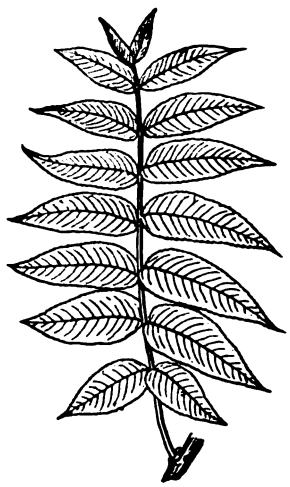
JUBÛBA, Jujuba: *Zizyphus.*

JUDAS TREE: *Cercis.*

JÚGLANS (ancient Latin name from *Jovis glans*, nut of Jupiter). *Juglandàceæ.* Walnut. Butternut. Plate LX. Woody plants grown for their handsome foliage and some species for their edible nuts.

Deciduous trees, rarely shrubs: branches with lamellate pith: lvs. alternate, without stipules, odd-pinnate, of aromatic fragrance when bruised: staminate fls. with a 2–5-lobed perianth and 6–30 stamens, in slender catkins; pistillate fls. in few- to many-fld. racemes; ovary inferior, 1-celled, with 4 calyx-lobes and included in a 3-lobed involucre: fr. a large drupe with a thick, indehiscent husk; nut 2- or 4-celled at the base, indehiscent or separating at last into 2 valves. —About 15 species in N. and S. Amer. and from S. E. Eu. to E. Asia; 44 species have been distinguished and described in a monograph by Dode (B.S.D. 1906: 67–97; 1909: 22–50, 165–215, with many illustrations).

The walnuts are usually tall broad-headed trees with large leaves, and with small greenish flowers, the staminate in pendulous slender often conspicuous catkins, the pistillate inconspicuous followed by a greenish large drupe containing an edible nut. Most of the species are hardy, and are very valuable park trees, with a massive, straight trunk, and a light and airy broad top, the best being probably *J. nigra*, one of the noblest trees of the American forest. *J. regia*, *J. rupestris*, and *J. cathayensis* are hardy as far north as Massachusetts, while *J. californica* is tender in the North. Though many fungi and insects prey on the walnut, none of them does very serious damage, the worst being, perhaps, the hickory-borer. The wood of the walnut, which is easily worked and susceptible of receiving a beautiful polish, is much used for cabinet making and the interior finish of houses, especially that of *J. nigra* and *J. regia*, which is heavy, strong and durable, and of dark brown color, while that of *J. cinerea* and *J. Sieboldiana* is light and soft. The husks of the nuts are sometimes used for dyeing yellow, and the bark for tanning leather. The husk of *J. cinerea* has some medicinal properties. The nuts of all species are edible, and are an article of commercial importance, especially those of *J. regia*, which are the best. This species is extensively grown in the warmer parts of Europe, in California and in the East from Pennsylvania to Georgia. The nuts of the native species are also sold on the market, but mostly gathered in the woods, though a number of improved varieties are in cultivation. *J. Sieboldiana* and var. *cordiformis*, with nuts superior to those of the native species, and much valued in Japan, will probably become valuable nut trees where *J. regia* is too tender; also *J. regia* var. *sinensis* is hardier than the type.



2011. Leaf of Juglans nigra.

The walnut grows best in moderately moist, rich soil, but *J. cinerea* is more moisture-loving and *J. regia* prefers well-drained hillsides. They are not easily transplanted when older, and therefore the nuts are often planted where the trees are to stand, but they may be safely transplanted when two or three years old, or even later when they have been transplanted in the nursery. Propagation is by seeds, which should be stratified and not allowed to become dry. A light, sandy soil is to be preferred, as the young plants produce more fibrous roots, while in stiff soil they are liable to make a long taproot. The young seedlings are transplanted when about two years old; sometimes the taproot is cut by a long knife. Varieties are often grafted on potted stock in the greenhouse in early spring or are budded in summer, either shield- or flute-budding being employed; even top-grafting of old trees is sometimes practised. For culture and further information, see United States Department of Agriculture, "Nut Culture in the United States," quoted below as U. S. N. C.; see, also, *Walnut.*

INDEX.

ailantifolia, 10.
alata, 12.
Allardiana, 10.
asplenifolia, 1.
Bartheriana, 1.
californica, 4, 5.
cathayensis, 8.
cinerea, 7.
coarctata, 10.
corcyrensis, 1.
cordiformis, 10.
draconis, 8.
Duclouxiana, 1.
elongata, 1.
fertilis, 1.
filicifolia, 1.
fruticosa, 1.
gibbosa, 11.
Hindsii, 5.
intermedia, 11, 12.
laciniata, 1.
Lavallei, 10.
major, 2.
mandshurica, 9.
monophylla, 1.
nigra, 6.
ovoidea, 6.
pendula, 1.
præparturiens, 1.
pyriformis, 11.
quadrangulata, 12.
quercina, 5.
quercifolia, 5.
regia, 1.
rupestris, 2, 3.
Sieboldiana, 10.
sinensis, 1.
subcordiformis, 10.
Torreyi, 2.
Vilmoreana, 11.
Vilmoriniana, 11.

A. *Fr. glabrous or finely pubescent, 1–3; nut 4-celled at the base.*

B. *Lfts. usually 7–9, almost entire.*

1. **règia,** Linn. PERSIAN or ENGLISH WALNUT. Round-headed tree, to 70 ft.: lfts. 5–13, oblong or oblong-ovate, acute or acuminate, almost glabrous, bright green, 2–5 in. long: fr. almost globular, green; nut usually oval, reticulate and rather smooth, rather thin-shelled. S. E. Eu. Himalayas, China. U. S. N. C. pl. 6. H.W. 2:36, pp. 87–9. M.D. 1911, p. 197 (habit). Many varieties are cult. as fr. trees, for which see *Walnut*. Var. **sinénsis,** DC. (*J. sinénsis*, Dode). Lfts. usually 5, larger, pubescent on the veins below: nut globose-ovoid, very rugose. China, Japan. S.I.F. 2:5. Of the ornamental varieties the most distinct and decorative is var. **laciniàta,** Loud. (var. *filicifòlia*, Hort. var. *asplenifòlia*, Hort.), with narrow, pinnately cut lfts.; very effective as a single specimen on the lawn; remains usually shrubby. M.D.G. 1908:617. Var. **monophýlla,** DC., has the lvs. simple or 3-foliolate. Var. **péndula,** Kirchn., has pendulous branches. Var. **fértilis,** Kirchn. (var. *fruticòsa*, Dipp. var. *præpartùriens*, Hort.), is a shrubby variety producing rather small, thin-shelled nuts on very young plants. Var. **Bartheriàna,** Carr. (var. *elongàta*, Hort.). Nut elongated, narrow-oblong. R.H. 1859, p. 147; 1861, p. 427. Gn. 50, p. 478. Var. **corcyrénsis,** Sprenger. Lvs. large, to 2 ft. long; lfts. 9, the lowest pair very small, the upper pairs broadly ovate, about 8 in. long and 5 in. broad: nut rather thick-shelled. *J. Duclouxiàna*, Dode, from the Himalayas and W. China with more elliptic and more acuminate lfts. and nuts with thin fragile shell, is probably only a variety of *J. regia*.

2012. Pistillate flowers of Juglans cinerea. (Natural size.)

BB. *Lfts. 9–25.*

C. *Width of lfts. usually less than 1 in.*

D. *Nuts deeply grooved.*

E. *Diam. of nut up to 1½ in.: lfts. 9–13.*

2. **màjor,** Heller (*J. rupéstris* var. *màjor*, Torr. *J. Tórreyi*, Dode). Tree, to 50 ft., with narrow head: branchlets pubescent while young: lfts. 9–13, rarely to 19, oblong-lanceolate to ovate, acuminate, cuneate or rounded at the base, coarsely serrate, soon glabrous or slightly pubescent on the midrib beneath, 3–4 in. long, the lowest lfts. 1½–2 in. long: stamens 30–40: fr. subglobose or ovoid, 1–1½ in. across, covered with a close rufous tomentum; nut dark brown or black, slightly compressed, with broad deep longitudinal grooves, with a thick shell and small sweet kernel. New Mex., Ariz., Colo. S.S. 7:336.

EE. *Diam. of nut not more than ¾in.: lfts. 11–23.*

3. **rupéstris,** Engelm. Shrub or small tree, rarely to 30 ft.: branchlets pubescent when young: lfts. 17–23, narrow-lanceolate, acuminate, finely serrate or nearly entire, puberulous or pubescent when young, at maturity quite glabrous or pubescent on the midrib beneath, 2–3 in. long: stamens about 20; ovary pubescent or tomentose: fr. globular, rarely ovoid, often pointed, usually pubescent, ½–¾in. across; nut with deep longitudinal grooves, thick-shelled, with small kernel. Texas and N. Mex. S.S. 7:335. G.W. 11, p. 399.

2013. Juglans mandshurica. (Natural size.)

4. **califórnica,** Walt. Shrub or tree, 12–20, rarely 40–50 ft. high: branchlets puberulous: petioles glandular-pubescent; lfts. 11–15, rarely to 19, oblong-lanceolate, usually acute, or acuminate, cuneate or rounded at the base, glabrous, 1–2½ in. long: stamens 30–40: fr. globose, ⅓–¾in. across, puberulous, husk thin; nut nearly globose with deep longitudinal grooves. S. Calif. S.S. 7:337, figs. 1–4.

DD. *Nut obscurely or not at all grooved, up to 2 in. across.*

5. **Hindsii,** Sarg. (*J. califórnica* var. *Hindsii*, Jepson). Rounded-headed tree, 30–40, occasionally to 75 ft. high, with tall trunk: branchlets densely pubescent at first: petioles villous; lfts. 15–19, usually 19, ovate-lanceolate to lanceolate, long-acuminate, usually rounded at the base, coarsely serrate, pubescent beneath on the midrib and veins, 2½–4 in. long: stamens 30–40: fr. globose, 1¼–2 in. across, soft-pubescent; nut nearly globose, faintly grooved, with thick walls. Cent. Calif. S.S. 7:337, figs. 5–8. Gn. 49, p. 278.—A graceful ornamental tree often planted as a street tree in Calif. and used as stock for grafting varieties of the English walnut. The nut is of good quality, but rather small. Var. **quércina,** Sarg. (*J. califórnica quércina*, Babcock. *J. quercifòlia*, Pierce). An abnormal form with 1–5 lfts., usually 3, short-stalked or sessile, broadly ovate to oblong, obtuse or emarginate, serrate or entire, ½–2 in. long. Jepson, Silv. Calif., pp. 51–3.

CC. *Width of lfts. 1 in. or more: nut prominently and irregularly ridged.*

6. **nigra,** Linn. BLACK WALNUT. Fig. 2011. Lofty tree, to 150 ft., with rough brown bark and pubescent branchlets: lfts. 15–23, oblong-lanceolate, acuminate, appressed-serrate, glabrous and somewhat shining above at length, pubescent beneath, 3–5 in. long: fr. usually 1–3 on a short stalk, 1½–3 in. across, with papillose surface; nut thick-shelled, globular or somewhat depressed, strongly ridged. Mass. to Fla., west to Minn. and Texas. S.S. 7:333, 334. Em. 211. G.C. II. 11:373; 26:617; III. 30:303. F.S.R. 3:210. H.W. 2, p. 182. U. S. N. C. 7, pp. 1–3. Gn. 27, pp. 269, 270. —*J. ovoidea*, Dode, is a form with ovoid pointed nuts.

AA. *Fr. coated with viscid hairs, racemose; nut 2-celled at the base: lfts. with stellate and glandular pubescence beneath, serrate.*

B. *Nut strongly 6–8-ridged.*

7. **cinèrea,** Linn. BUTTERNUT. WHITE WALNUT. Fig. 2012. Large tree, occasionally to 100 ft., with

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gray bark: young branchlets villous and glandular: lfts. 11–19, oblong-lanceolate, acuminate, appressed-serrate, usually pubescent on both sides, more densely below, 3–5 in. long: fr. in short racemes, 2–5, oblong, pointed, 3–5 in. long; nut oblong, with 4 more and 4 less prominent irregular ribs and many broken sharp ridges between. New Bruns. to Ga., west to Dak. and Ark. S.S. 7:331, 332. Em. 207. U. S. N. C. 7, p. 4. Gn. 22, p. 251.

8. **cathayénsis,** Dode (*J. dracònis,* Dode). Tree, to 70 ft.: branchlets glandular-hairy: lvs. up to 3 ft. long; lfts. 9–17, obovate-oblong, acuminate, obliquely

2014. Juglans Sieboldiana. (×⅓)

rounded or subcordate at the base, serrulate, sparingly hairy above, more densely below, midrib glandular, 3–9 in. long: fr. 6–10 in pendulous racemes, ovate, pointed, 1¼–1¾ in. long; nuts ovoid, pointed, 6–8-angled, with sharp and broken, nearly spiny ridges. Cent. and W. China. G.C. III. 50:189.—Has proved hardy at the Arnold Arboretum.

9. **mandshùrica,** Maxim. Fig. 2013. Broad-headed tree, to 60 ft.: branchlets glabrescent: lfts. 11–19, oblong, acute, obtusely serrate, at length almost glabrous above, pubescent beneath, rarely almost glabrous at length, 3–8 in. long: fr. in short racemes, globular-ovate to oblong; nut with 8 prominent obtusish ridges. Mandshuria, Amurland. G.C. III. 4:384; 30:302. A.G. 1891:178. R.H. 1861, p. 429 (as *J. regia octogona*). Gn. 50, p. 478 (by error as *J. regia cordata*). U.S.N.C. 7, p. 5.

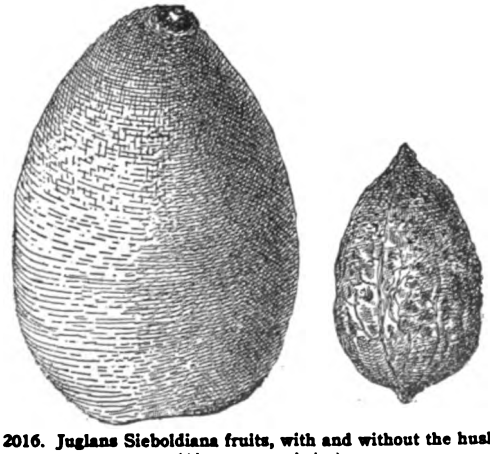
BB. *Nut rugose or nearly smooth.*

10. **Sieboldiàna,** Maxim. (*J. ailantifòlia,* Carr.). Figs. 2014–2016. Broad-headed tree, to 50 ft.: branchlets pubescent: lfts. 11–17, oval to oval-oblong, short-acuminate, densely serrate, glabrous above, pubescent and usually glandular beneath, 3–6 in. long: frs. in long racemes, sometimes 20, globose to ovate-oblong; nut more or less globose, with thick, wing-like sutures and pointed apex, the surface rather smooth, slightly rugose and pitted, 1–1½ in. long, rather thick-shelled. Japan. Gn. 47, p. 442. A.G. 1890:701; 1891:179. R.H. 1878, pp. 414, 415. U.S.N.C. 7, p. 7. S.I.F. 2:5. Var. **cordifórmis,** Makino (*J. cordifórmis,* Maxim.). Fig. 2017. Nut heart-shaped or ovoid, much flattened, sharply 2-edged, smooth and with a shallow longitudinal groove in the middle of the flat sides, rather thin-shelled. G.C. III. 30:292. S.I.F. 1:17. U.S.N.C. 7, p. 6.—Though this form is very different in its fr. from the true *J. Sieboldiana* there are no other reliable characters to distinguish it, and seedlings raised from nuts of var. *cordiformis* have always produced, at least to a large percentage, trees bearing nuts like those of *J. Sieboldiana* or of intermediate character. Probably *J. Lavàllei,* Dode (L.I. 1, 2), is such an intermediate form. *J. coarctàta,* Dode, is another of these intermediate forms with a somewhat longer nut slightly constricted about the middle. *J. subcordifórmis,* Dode, is hardly different from the variety except in its shorter and broader nuts. *J. Allardiàna,* Dode, is probably only a form of the species; it differs little from it except in the gray or blackish dull color of the nut, which is yellowish and lustrous in typical *J. Sieboldiana.*

2015. Winter twig of Juglans Sieboldiana.

11. **intermèdia,** Carr. (*J. nìgra* × *J. règia*). Intermediate between the parents, but in general appearance more like *J. regia.* Lfts. usually 11, ovate or elliptic-ovate, remotely denticulate, glabrous dark green. In regard to the fr. 2 forms have been distinguished. Var. **pyrifórmis,** Carr., with an obovoid fr. more resembling that of *J. regia.* R.H. 1863, p. 30. Gn. 50, p. 478. Var. **Vilmoreàna,** Carr. (*J. Vilmoriniàna,* Vilm.). Fig. 2018, with a fr. more like that of *J. nigra.* G.F. 4:52, 53 (adapted in Fig. 2018). M.D. 1911:197.—Probably also *J. regia gibbosa,* Carr., with a large, thick-shelled deeply rugose nut belongs here. R.H. 1861, p. 428. Gn. 50, p. 478. Of the same parentage is without doubt the so-called James River hybrid (Forest Leaves 2:133, 134).

12. **quadrangulàta,** Rehd. (*J. alàta,* Schelle. *J. intermèdia quadrangulàta,* Carr. *J. intermèdia alàta,* Carr. *J. cinèrea* × *J. règia*). Fig. 2019. Tall tree, in its bark, winter-buds and foliage much resembling *J. regia:* lfts. usually 9, oval to oblong, obscurely and remotely serrate, slightly pubescent beneath: fr. sparingly produced, subglobose, about 2 in. long; nut ovoid-oblong, acute at the apex, 1¾ in. long, with deeply sculptured walls thinner than those of the butternut



2016. Juglans Sieboldiana fruits, with and without the husk. (About natural size)

and broad ridges at the sutures. Originated in France and in several places near Boston and probably elsewhere. G.F. 7:435 (adapted in Fig. 2019). R.H. 1870, p. 494. Gn. 50, p. 478.—The form figured by Carriere seems much nearer to *J. cinerea*, while the form originated near Boston is more similar to *J. regia*.

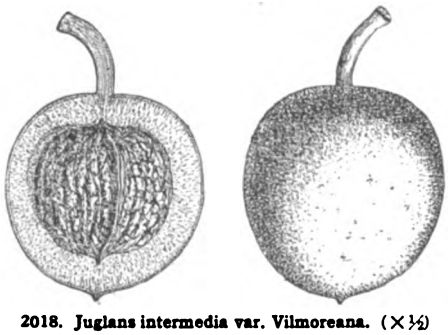
2017. Juglans Sieboldiana var. cordiformis. (Natural size)

Besides these described above, several other hybrids have been reported. Luther Burbank raised a hybrid between J. Hindsii and J. nigra, named "Royal," with large nuts of excellent flavor, and one between J. Hindsii and J. regia, named "Paradox," a very vigorous grower, but a shy bearer. There are supposed hybrids between J. mandschurica × J. regia, J. cinerea × J. nigra and J. cinerea × J. rupestris; J. longirostris, Carr. (R. H. 1878, p. 53), may be a hybrid between J. regia and J. major, which often has a fr. similar in shape to the one figured.—*J. australis*, Griseb. Allied to J. rupestris. Lfts. 13–21, large, ovate-oblong, abruptly acuminate, serrate, viscid-pubescent: nut ovoid, acute, small, slightly grooved. Argentina.—*J. colléta*, Dode. Allied to J. mandschurica and probably only a variety, but nut less rugose, less sharply angled, with ovoid depressions. Probably from N. China.—*J. kamaònia*, Dode (J. regia var. kamaonia, DC.). Allied to J. regia. Lfts. 5–11, oblong-elliptic to oblong-lanceolate, puberulous on both sides, rufous-pubescent on the veins beneath: nut globose, rather hard-shelled. Himalayas.—*J. stenocárpa*, Maxim. Closely allied to J. mandschurica. Lfts. narrower, more coarsely serrate, more pubescent, the terminal lft. very large: fr. more oblong, less strongly ridged. Manchuria.

ALFRED REHDER.

JUJÚBE: *Zizyphus Jujuba.*

JULIÀNIA (Julian Cervantes). Doubtfully associated with the *Anacardiàceæ*, but now made the type of the family *Julianiàceæ*. Tortuously branched resinous dicœcious shrubs or small trees of Mex., perhaps not in cult.: lvs. alternate, unequally pinnate, the lfts. 3–11: fls. small, green; male fls. and infl. much like those of the oak, "a single, hairy, thin perianth, divided nearly to the base into 5 or 7 acute segms., with as many stamens alternating with the segms."; female fls. 2–4 in an involucre, the whole having the appearance of a single fl., of curious structure: fr. composite, dry, with an exceedingly hard involucre, indehiscent, germination taking place through the apex. The known species are 4, one of which, *J. adstringens*, Schlecht., is figured in G.C. III. 43:99, by Hemsley (adapted from Trans. Roy. Soc. of London). Aspect somewhat like some species of Rhus: lfts. 5–7, sessile or the terminal very short-stalked, 1–1½ in. long, obovate or oval, dentate: fr. 2 in. long, enlarging upward. *J. Huaucùi*, Gray, of Peru, is referred to Orthopterygium; probably not in cult.



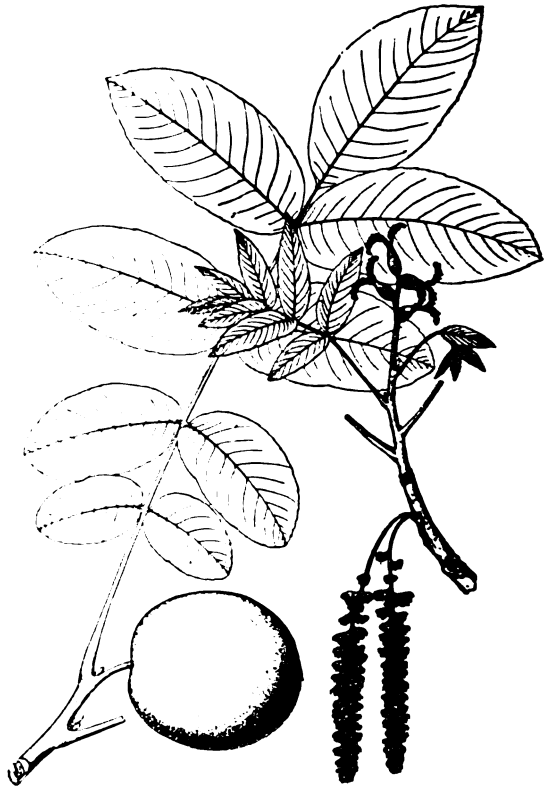
2018. Juglans intermedia var. Vilmoreana. (×½)

JÚNCUS (classical name, *to join*). *Juncàceæ*. RUSHES. Grass-like plants growing in wet, rarely in dry, places and used for planting in bogs and around aquatic gardens.

Plants send up from the rootstock several unbranched cylindrical sts. which bear a terminal, or sometimes apparently lateral, cyme of greenish or brownish very small fls.: lvs. grass-like terete or flat: perianth of 6 rigid chaffy parts in 2 whorls; stamens short, either 3 or 6: caps. 3-celled or rarely 1-celled, many-seeded. Rushes differ from the true grasses and sedges in having a true perianth and a many-seeded pod.—The genus includes a host of species distributed throughout the temperate regions, but most of these are not in cult. Rushes are sold by dealers in native and aquatic plants. The kind used in making mats in Japan is procurable from dealers in Japanese plants.

A. *St. without lvs.: cymes apparently lateral.*

effùsus, Linn. (*J. commùnis*, Hort.). COMMON RUSH. Fig. 2020. St. soft, 1–4 ft. high: cyme diffuse,



2019. Juglans quadrangulata. (×½)

1–2 in. long, the fls. separate; sepals acute, equaling the short retuse and pointless or mucronate greenish brown caps.; stamens 3: seeds not tailed. North Temperate Zone. Used also for weaving into mats, and the like. Var. **compàctus,** Lej. & Coutt. (var. *congéstus*, Hort.). Fls. small, ¾–1½ lines long: cyme congested into a spherical head: culms rather stout, finely many striate. Much of the *J. conglomeratus* of the trade is probably this variety. Var. **conglomeràtus,** Engelm., is similar to the last, but the culm coarsely few (12–15) striate, and perianth very dark. Var. **solùtus,** Fern. & Wiegand. Fls. medium, 1½–2½ lines long; perianth semi-appressed: cyme open: culms coarse with usually pale basal sheaths, at least when dry. Var. **Pylæi,** Fern. & Wiegand. Fls. medium; perianth spreading:

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cyme open: culm medium, usually coarsely striate at least when dry: basal sheaths usually dark. Var. **vittàtus**, Buch. (*J. effùsus* var. *aùreo-striàtus*, Hort. *J. conglomeràtus* var. *variegàtus*, Hort.). Foliage striped with yellow. Var. **spiràlis**, Hort. Fig. 2021. A curious form with sts. spirally twisted like a corkscrew. Gt. 54, p. 406.

AA. *St. bearing terete lvs.: cyme terminal, open, but fls. borne in heads at end of branches.*

canadénsis, Gay. Sts. 1½–3 ft. high, tall and coarse: heads numerous; stamens 3: seeds long-tailed at each end. N. Amer.

nodòsus, Linn. Sts. lower, ½–1½ ft. high: heads few; stamens 6: seeds without tails. N. Amer.—May be used for gravelly borders of pools.

J. acuminàtus, Michx., and other species may be used for water-gardens.—*J. sebrinus*, Hort.=Scirpus Tabernæmontanus var. sebrinus.

K. M. WIEGAND.

2020. Common rush, Juncus effusus. The flower-cluster, *a*, is natural size. The single flower, *b*, is enlarged.

JUNEBERRY. Fig. 2022. Fruits of species of Amelanchier.

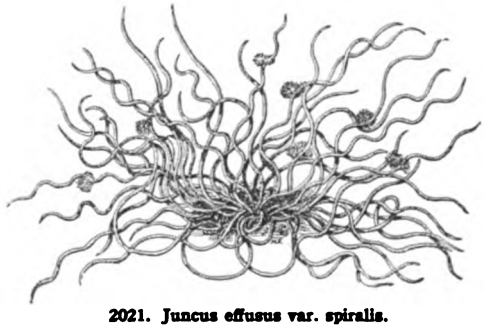
The fruits of some twenty-five or thirty species of Amelanchier are edible, those of several species being especially juicy, sweet and refreshing. Under the names juneberry, shad-bush, service-berry, sugar-pear and grape-pear, or their equivalents in other languages, the wild fruits are used for food in all parts of the North Temperate Zone. The product of one or another of the species plays an important part in the diet of North American Indians, who make use of the berries both fresh and dried. So, also, juneberries have been a source of food-supply to explorers, prospectors and pioneers, who testify to their value as nourishing esculents and pleasing dessert fruits. Juneberries are as yet little used where they must compete with other fruits, although they have many qualities to commend them for domestication.

The fruit of the juneberry is a small pome or apple, usually with five cells each more or less completely divided into two parts so that there appear to be ten cells. The seeds are small and thin-shelled, varying in number from five to ten. The pomes of some species are no larger than a pea, while in the best strains of other species they attain the size of a small crab-apple. They vary in color from dark red to a purplish blue or black and all have more or less bloom. The fruits resemble somewhat the pomes of the hawthorn, for which they are often mistaken. The juneberry, however, is superior to the more common hawthorn as a food product because the flesh is greater in quantity and is not so dry and mealy, the flavor is sprightlier and the seeds are fewer, smaller and thinner-shelled. The several juneberries are quite as variable in the character of their fruits, either within or between species, as are other members of the rose family to which Amelanchier belongs—sufficiently variable to suggest high potentialities in the domestication of the best of the wild species.

Juneberries differ much in the character of the plants. Some species are dwarf shrubs with many stems, while others are small trees with straight, slender trunks, the largest of which attain a height of 40 feet and a diameter of 8 or 10 inches. All of the species are vigorous and the American juneberries are hardy, at least two of them giving promise of making most desirable domesticated plants in regions too cold for any or but few other fruits. Juneberries are easily transplanted and respond to culture as readily as any other species of the rose family. In the garden, they thrive under the same care as that given the apple or pear. Insects and fungous troubles are not particularly apparent in wild species but it is probable that under artificial conditions juneberries would suffer from about the same insects and fungi that attack other pomes. Birds, especially the robin, take heavy toll and would prove troublesome to cultivated plants. The genus shows wide adaptation to soils and moisture conditions, there being few localities in temperate regions where other fruits are grown upon which some one or several of the juneberries would not thrive.

All of the plants in this genus, whether shrubs or trees, have value as ornamentals. The common juneberry of eastern America is a particularly beautiful plant in early spring, bearing large white flowers in profusion, which are well set off by the opening foliage and bright silky bud-scales and bracts. The trees are attractive ornamentals in fruit though the eastern juneberry is often infertile and sets few or no pomes. Trained as a tree or as a many-stemmed shrub, the several juneberries are all desirable lawn and park ornamentals.

From time to time strains of wild species have been brought under cultivation, some of which have been named and sparingly disseminated by nurserymen. So far all of the cultivated varieties have come from the bush-like species, most of them said to be from *A. alnifolia*. One of the first named varieties was Success, a dwarf strain probably of *A. canadensis*, introduced by H. E. Van Deman, then of Kansas, about 1878; this variety seems to be no longer cultivated. Several western nurserymen now offer strains of dwarfs under the names Improved Dwarf Juneberry, Dwarf Mountain Juneberry, and Western Huckleberry. So far as



2021. Juncus effusus var. spiralis.

their history can be learned, all these named varieties are selected strains from wild plants, no one as yet having set out to breed and improve juneberries. There are many distinct forms in the wild, some of them supposed to be natural hybrids, offering opportunities for selection in the amelioration of the species for the garden. There is no reason to believe that the species will not hybridize as freely as other members of the rose family. All looks to be favorable for the domestica-

tion of juneberries,—opportunities awaiting a man to do the work.

Juneberries are readily propagated from seeds and no doubt all would yield to budding, grafting and to the same treatment in the nursery given to apples and pears. Some of the species would, no doubt, vex the souls of cultivators by throwing up many suckers, but in garden culture this could be remedied by working on a non-suckering stock. Juneberries are said to be easily budded on the hawthorn. The suckers are commonly used in propagating the species used as ornamentals.

2022. Juneberry. A cultivated form, probably a hybrid between Amelanchier lævis and some other species.

The eleven species described under Amelanchier all have horticultural possibilities well indicated in the descriptions. The species giving greatest promise for their fruits are *A. alnifolia*, *A. lævis*, *A. sanguinea*, *A. stolonifera* and *A. humilis*. To these should be added *A. canadensis* as the most desirable juneberries for ornamentals.

U. P. HEDRICK.

JUNÍPERUS (ancient Latin name). *Pinàceæ*. JUNIPER. Ornamental trees and shrubs grown for their foliage and habit.

Evergreen, with the branchlets spreading in all directions: lvs. either all needle-shaped and in 3's, or needle-shaped and scale-like, and usually opposite, often found on the same plant, the needle-shaped lvs. prevailing on younger plants and vigorous branches, the scale-like ones on older plants: fls. diœcious, rarely monœcious; staminate yellow, consisting of numerous anthers united into an ovoid or oblong catkin; pistillate greenish, minutely globular, with several bracts, each or some bearing 1 or 2 ovules; the bracts become fleshy and unite into a berry-like cone, usually wholly inclosing the 1–6, rarely 12, seeds. The fr. ripens either the first year, as in *J. virginiana*, or the second, as in *J. Sabina* and most species, or in the third, as in *J. communis*.—About 40 species distributed throughout the extra-tropical regions of the northern hemisphere, in Amer. south to Mex. and W. India. Juniperus is closely allied to Cupressus, and sometimes hard to distinguish without fr.; but young plants with needle-shaped lvs. can be almost always told apart, since Juniperus has whitish lines or marks on the upper surface of the lvs., while the similar juvenile forms of allied genera have the whitish marks beneath. Most species are very variable, as well in habit as in the shape of the lvs., which renders the determination of an unknown form, at least without fr., a rather difficult task.

The junipers vary greatly in habit from tall pyramidal trees to low prostrate or trailing shrubs, and have small needle-shaped or scale-like foliage, insignificant flowers and small berry-like fruits usually bluish black and often glaucous, less often brown or orange. Many of the species are hardy North, as *J. virginiana*, *J. scopulorum*, *J. communis*, *J. rigida*, *J. Sabina*, *J. chinensis*, *J. Pseudo-sabina*, *J. sphærica*, *J. squamata*; others are half-hardy, as *J. Oxycedrus*, *J. macrocarpa*, *J. recurva*, *J. excelsa*, *J. occidentalis*, while some, as *J. procera*, *J. Lucayana*, *J. thurifera* and the Mexican species, can only be grown South. All are valuable ornamental plants, and the erect-growing species, mostly of pyramidal or columnar habit, are decorative as single specimens on the lawn or if planted in groups. Some varieties form a very narrow column, and are valuable for formal gardens; the columnar form of *J. virginiana* is a good substitute in the North for the classical cypress. The low prostrate junipers, as *J. communis* var. *montana*, *J. horizontalis*, *J. Sabina*, and *J. squamata*, are well adapted for covering rocky slopes or sandy banks. The close-grained, fragrant wood is much used for the interior finish of houses and in the manufacture of small articles, also for posts, since it is very durable in the soil; that of *J. virginiana* and *J. Lucayana* is in great demand for pencil-making. The fruits and also the young branchlets of some species contain an aromatic oil used in medicine. The fruit of *J. drupacea* is edible.

The junipers thrive best in sandy and loamy, moderately moist soil, but grow well even in rather dry, rocky and gravelly ground. They prefer sunny, open situations. They are well adapted for hedges and for planting as shelter or windbreaks; also for seaside planting. Propagation is by seeds, which germinate usually the second and sometimes the third year; to hasten their germination, they may be plunged for 3 to 6 seconds in boiling water, but this should be regarded as an experiment and tried only with a portion of seed. They are also increased by cuttings of nearly ripened wood in fall under glass, either outdoors or in the greenhouse. As a rule, those with needle-shaped leaves root much more easily than those with scale-like leaves, and the latter are therefore mostly increased by side-grafting during the winter in the greenhouse on young potted plants of the typical form or an allied species. The shrubby species, especially *J. Sabina*, are also propagated by layers.

INDEX.

albo-spicata, 16.
albo-variegata, 14, 16.
alpina, 6.
argentea, 14.
aurea, 6, 14.
aureo-variegata, 6, 14, 16.
australis, 18.
barbadensis, 18, 19.
Bedfordiana, 18.
bermudiana, 19.
californica, 10.
canadensis, 6.
Cannartii, 16.
Cedrus, 3.
Chamberlaynii, 16.
chinensis, 14.
communis, 6.
cupressifolia, 20.
densa, 7.
depressa, 6.
Douglasii, 21.
drupacea, 1.
dumosa, 16.
elegantissima, 16.
excelsa, 12.
Fargesii, 8.
fastigiata, 6, 20.
femina, 14.
Fortunei, 15.
glauca, 15, 16.
gioiosa, 16.
hemisphærica, 6.
hibernica, 6.
horizontalis, 21.
humilis, 20.
Jackii, 6.
japonica, 14.
Lucayana, 18.
macrocarpa, 2.
mascula, 14.
montana, 6.
nana, 6.
neaboriensis, 2.
oblonga, 6.
oblongo-pendula, 6, and suppl.
occidentalis, 11.
Oxycedrus, 4.
pendula, 3, 6, 14, 16.
Pfitzeriana, 14.
phœnicea, 9.
plumosa, 16.
procera, 13.
procumbens, 14, 21.
prostrata, 21.
pyramidalis, 14, 16.
recurva, 7, 8.
Reevesii, 14.
reflexa, 6.
repanda, 7.
repens, 21.
reptans, 16.
rigida, 5.
Sabina, 20.
sabinoides, 20 and suppl.
Schottii, 16.
scopulorum, 17.
Shephardii, 15.
sibirica, 6.
sinensis, 14.
sphærica, 15.
squamata, 8.
stricta, 6, 12.
suecica, 6.
tamariscifolia, 20.
tripartita, 16.
variegata, 12, 20.
venusta, 16.
virginiana, 16, 18.

A. *Foliage always needle-shaped and in 3's, rigid, jointed at the base: fls. axillary, diœcious: winter-buds with scale-like lvs. (See also Nos. 7 and 8.)*

B. *Fr. large, ¾–1 in. across, with the seeds connate into a usually 3-celled bony stone. (Caryocedrus.)*

1. **drupàcea,** Labill. Pyramidal tree with narrow head, to 45 ft.: lvs. lanceolate, spiny-pointed, ½–¾in. long and ⅛–⅙in. broad (the broadest of all species), with 2 white lines above: fr. bluish black, edible. S. E. Eu., W. Asia. G.C. 1854:455; III. 19:519. R.H. 1854, p. 165; 1904, pp. 357, 358.

BB. *Fr. smaller; seeds not connate, usually 3. (Oxycedrus.)*

C. *Lvs. with 2 white lines above.*

2. **macrocárpa,** Sibth. (*J. neaboriénsis,* Gord.). Shrub or small tree, to 12 ft., of dense pyramidal habit: lvs. crowded, linear-lanceolate, spiny-pointed, spreading, ½–¾in. long: fr. to ½in. across, dark brown, glaucous. Medit. region.

3. **Cèdrus,** Webb & Berth. (*J. péndula,* Loud.). Tree, to 12 ft., with pendulous branches; the trunk to 3 ft. diam.: branchlets bluish green, angled: lvs. very crowded, curved or straight, spreading, linear-lanceolate, acute or obtusish, scarcely spiny, ¼–½in. long: fr. subglobose, ⅓–½in. long, bluish at first, finally orange-brown, 1-seeded. Canary Isls. Antoine, Cupressineen Gatt. 19.—Cult. in Calif. The abnormal development of thickness in comparison to height is one of the peculiarities of the species.

4. **Oxycèdrus,** Linn. Bushy shrub or small tree, to 12 ft., with rather slender branches: lvs. linear, spiny-pointed, spreading, ½–¾in.: fr. globose, ¼–⅓in. across, brown, shining, not or slightly glaucous. Medit. region. H.W. 1, p. 193.

CC. *Lvs. with 1 white line above.*

5. **rígida,** Sieb. & Zucc. Small, pyramidal tree, to 30 ft., or spreading shrub with the slender branches pendulous at the extremities: lvs. in closely set whorls, narrow-linear, stiff, yellowish green, ½–1 in. long: fr. about ¼in. across, dark violet. Japan. S.Z. 125. S.I.F. 1:12.—Graceful, hardy shrub, somewhat similar to *J. communis* var. *oblonga,* but the lvs. more crowded and stiffer.

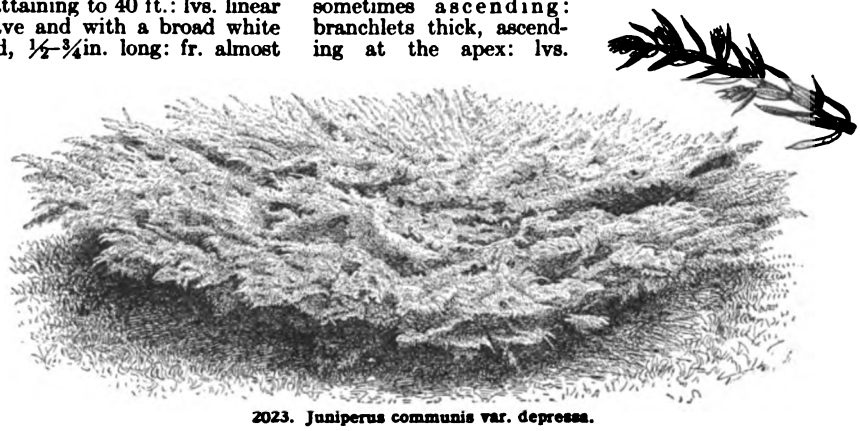
6. **communis,** Linn. Common Juniper. Upright shrub or tree, sometimes attaining to 40 ft.: lvs. linear or linear-lanceolate, concave and with a broad white band above, spiny-pointed, ½–¾in. long: fr. almost sessile, dark blue, glaucous, ¼–⅓in. across. Arctic N. Amer. south to Pa., Ill., and in the Rocky Mts. to N. Mex., N. and Cent. Eu. and N. Asia. H.W. 1:10.—A very variable species; some of the most important varieties are the following: Var. **aùreo-variegàta,** Hort. Upright form, with the tips of the branchlets golden yellow. Var. **depréssa,** Pursh (*J. communis* var. *canadénsis,* Loud. *J. canadénsis,* Burgsd. *J. nàna canadénsis,* Carr.). Fig. 2023. Forming broad patches, the sts. ascending from a procumbent base, rarely exceeding 4 ft. in height. The lvs. somewhat shorter and broader. Var. **aùrea,** Hort. (*J. nàna* var. *canadénsis aùrea,* Beissn. *J. canadénsis aùrea,* Hort.). Like the former, but tips of branchlets golden yellow. Gng. 5:67. Var. **hemisphærica,** Parl. (*J. hemisphærica,* Presl). A low, dense, rounded bush, rarely more than 3 ft. high: lvs. straight and stiff, short. Mountains of S. Eu. and N. Afr. Var. **hibérnica,** Gord. (var. *stricta,* Carr.). Narrow, columnar form, with upright branches, deep green, tips of branchlets erect. G. 4:521. Gng. 1:355. Var. **montàna,** Ait. (*J. communis nàna,* Loud. *J. nàna,* Willd. *J. alpìna,* S. F. Gray. *J. sibírica,* Burgsd.). Low, spreading or procumbent shrub, seldom over 2 ft. high: lvs. oblong-linear, abruptly pointed, usually incurved, densely clothing the branches, with a broad silvery white line above, ¼–½in. long. Arctic and mountainous regions. H.W. 1:10. M.D.G. 1910:123. Var. **Jáckii,** Rehd. Prostrate, with flagelliform trailing branches often to 3 ft. long, and almost unbranched except for occasional clusters of short lateral branchlets 1–2 in. long: lvs. linear-lanceolate, incurved. Ore., N. Calif. Var. **oblónga,** Loud. (*J. oblónga,* Bieb.). Upright shrub, with slender, diverging and recurving branches: lvs. thin, long-attenuate, horizontally spreading, bright green. Transcaucasia. Var. **oblóngo-péndula,** Carr. (var. *reflèxa,* Parl.). Similar to the preceding, but more decidedly pendulous. A very graceful form. C.L.A. 11:308. Var. **péndula,** Carr. Shrub, with spreading, recurving branches and pendulous branchlets. Var. **suècica,** Loud. (var. *fastigiàta,* Hort.). Narrow, columnar form, growing sometimes into a tree to 40 ft. high, with rather long, spreading lvs., the branchlets with drooping tips: of lighter and more bluish color than the similar var. *hibernica.*

AA. *Foliage usually of 2 kinds of lvs. (Fig. 2025) usually opposite, decurrent: fls. terminal: no distinct winter-buds. (Sabina.)*

B. *Lvs. in 3's, lanceolate, short, loosely appressed: fr. oblong.*

7. **recúrva,** Ham. (*J. repánda,* Hort.). Shrub or small tree, to 30 ft., with spreading and usually recurving branches: branchlets slender: lvs. crowded, curved, appressed, linear-lanceolate, pointed, grayish or glaucous green with a whitish band above, ⅛–¼in. long: fr. olive-brown or blackish purple, when fully ripe, about ¼in. long, 1-seeded. Himalayas. G.C. II. 19:468. Gn. 22, p. 107; 36, p. 215. Var. **dénsa,** Carr. Dwarf, with short, crowded branchlets: lvs. curved, grayish green. .

8. **squamàta,** Lamb. (*J. recúrva* var. *squamàta,* Parl. *J. recúrva* var. *dénsa,* Hort.). Decumbent shrub, sometimes ascending: branchlets thick, ascending at the apex: lvs. crowded, loosely appressed, linear-lanceolate or lanceolate, straight or slightly curved, grayish or bluish green, with 2 grayish white bands above: fr. bluish black, globose-ovoid, ¼–⅓in. across. Himalayas, W. China. Var. **Fárgesii,** Rehd. & Wilson. Tree, to 70 ft.: lvs. longer and narrower, linear-lanceolate, more spreading, usually about ⅓in. long, acuminate: fr. ovoid, ¼in. long. W. China. It has proved hardy at the Arnold Arboretum.



2023. Juniperus communis var. depressa.

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BB. *Lvs. mostly opposite, scale-like or of 2 kinds, usually with a gland on the back: fr. mostly globular.*

C. *Fr. erect or nodding: mostly trees.*

D. *Color of fr. reddish brown, with rather dry, fibrous flesh: lvs. minutely denticulate.*

9. **phœnícea,** Linn. Shrub or small tree, to 20 ft., with ovate-pyramidal head and upright branches: branchlets slender: lvs. acicular and spreading or scale-like, imbricate, rhombic, obtuse, opposite, often bluish green: fr. ⅛–½in. across, shining, with 3–6 seeds. S. Eu., N. Afr. Canary Isls. H.W. 1, p. 194. M.D. 1911, pp. 286, 287 (habit).

10. **califórnica,** Carr. Fig. 2024. Pyramidal tree, to 40 ft., or shrub with many erect branches: branchlets rather stout: lvs. usually in 3's, imbricate, rhombic, obtuse, thick, yellowish green, with conspicuous gland, only on vigorous branches acicular: fr. ¼–⅓in. long, with bluish bloom and with 1–2 large seeds. Calif. S.S. 10:517. R.H. 1854, p. 353. A.G. 1890:10.

DD. *Color of fr. bluish black or blue, with juicy, resinous flesh.*

E. *Imbricate lvs. usually in 3's, minutely denticulate.*

11. **occidentàlis,** Hook. Tree, to 40 feet, rarely to 60 ft., with spreading branches forming a broad, low head, or shrub with several upright sts.: branchlets stout and thick, imbricate, ovate, acute, grayish green, rarely acicular: fr. subglobose or ovoid, ¼–⅓in. long, with 2–3 seeds. Wash. to Calif. S.S. 10:521.

EE. *Imbricate lvs. opposite, entire or nearly so.*

F. *Seeds of fr. 2–6.*

G. *Point of imbricate lvs. acute: branchlets slender.*

12. **excélsa,** Bieb. Tree, to 60 feet, with pyramidal head and upright or spreading branches: lvs. ovate, spreading, mostly opposite, but in 3's on the lower branches, rhombic, bluish green: fr. bluish black, bloomy, globular, about ½in. across, with 3–6 seeds. Greece, W. Asia to Himalayas. Gt. 46, p. 209. Var. **stricta,** Hort. Of upright, columnar habit, with very glaucous foliage. Var. **variegàta,** Carr. Foliage variegated with yellowish white.

2024. Juniperus californica. (×⅓)

13. **prócera,** Hochst. Tree, to 100 or 150 ft., similar to the preceding: lvs. in 3's, or opposite, lanceolate and spreading or loosely appressed and ovate-lanceolate: fr. globose, small, about ¼in. across, 2–3-seeded. Mountains of E. Afr.—Probably the tallest species of the genus.

GG. *Point of imbricate lvs. obtuse.*

14. **chinénsis,** Linn. (*J. sinénsis,* Hort.). Tree, to 60 ft., or shrub, sometimes procumbent: branches rather slender: lvs. opposite or whorled, linear, pointed and spreading, with a white band above or scale-like, appressed, rhombic, obtuse: fr. globular, brownish violet, bloomy, ⅓–½in. across, with 2 or 3 seeds. Himalayas, China, Japan. S.Z. 126, 127. S.I.F. 1:12. G.C. III. 42:163. C.L.A. 11:308. G.W. 1, p. 305.—Very variable in habit: the staminate plant usually forms a much-branched, upright, pyramidal bush often almost columnar, while the pistillate has slender spreading branches. They are therefore often distinguished as var. **máscula** and var. **fémina** (var. *Reèvesii,* Hort.). The first one is the most desirable as an ornamental plant. Var. **álbo-variegàta,** Beissn. (var. *argéntea,* Hort.). Dwarf, dense form, with dimorphic lvs.: tips of branchlets mostly white. Gn.M 6:292. Var. **aùrea,** Beissn. (var. *máscula aùrea,* Hort. Upright form, with the young branchlets golden yellow, the color becoming more brilliant in the full sun. Var. **péndula,** Hort. With spreading branches, pendulous at the extremities. Var. **Pfitzeriàna,** Spaeth. Formin a broad pyramid with horizontally spreading branches and nodding branchlets, grayish green. G.W. 5, p. 403. Var. **pyramidàlis,** Carr. Narrow, pyramidal form, with bluish green, mostly needle-shaped foliage. Var. **procúmbens,** Endl. (*J. procúmbens,* Sieb. *J. japónica,* Carr.). Dense, low shrub with spreading, sometimes procumbent branches and mostly acicular lvs. in whorls, with 2 white lines above, longer and stouter than in the type. S.Z. 127, fig. 3. G.W. 13, p. 618. Var. **procúmbens aùrea,** Beissn. Branches robust and long, decumbent, with rather few branchlets, young growth golden yellow at first, changing to light green. Var. **procúmbens aùreo-variegàta,** Beissn. Dwarf, dense form, variegated with golden yellow.

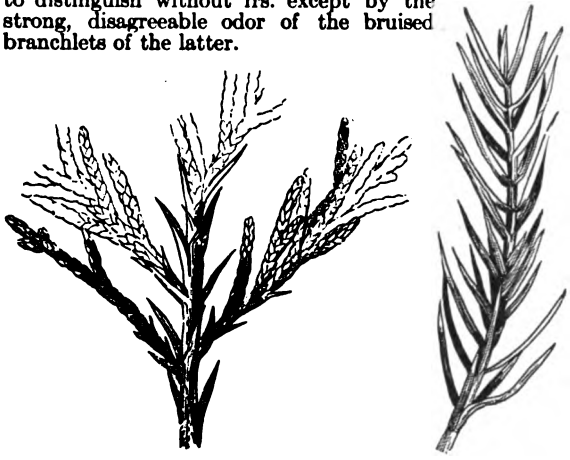
15. **sphærica,** Lindl. (*J. Fórtunei,* Van Houtte). Similar to the former. Densely branched shrub or tree, to 30 ft., with upright branches: branchlets short, rather thick, quadrangular: lvs. acicular and whorled, but less rigid than those of the former, or scale-like, rhombic-oblong, somewhat spreading: fr. globular, about ⅓in. across, not bloomy, 3-seeded. N. China. Probably not specifically different from the preceding species. Var. **glaùca,** Gord. (*J. Shéphardii,* Hort.). Dense form, with usually needle-shaped glaucous foliage.

FF. *Seeds of fr. 1–2; fr. small, ⅛–⅓in. across.*

G. *Trees hardy, sometimes shrubby.*

16. **virginiàna,** Linn. RED CEDAR. SAVIN. Fig. 2025. Tree, to 100 ft., with conical head and spreading or upright branches: lvs. acicular, spiny-pointed, spreading or scale-like, rhombic, acute or subacute, imbricate, very small: fr. brownish violet, bloomy, globular or ovoid. Canada to Fla., east of the Rocky Mts. S.S. 10:524. G.F. 8:65; 10:145. F.E. 27:147. G.W. 16, p. 540.—A very variable species. Some of the most important varieties are the following: Var. **álbo-spicàta,** Beissn. Tips of branchlets white. Var. **álbo-variegàta,** Beissn. Branchlets variegated with white; a very similar more constant form is "Triomphe d' Angers." Var. **aùreo-variegàta,** Hort. With golden yellow variegation. Var. **Cannártii,** Beissn. A compact, ovate-pyramidal form, dark green, with bloomy bluish fr. Var. **Chamberlàynii,** Carr. With spreading branches and elongated, pendulous branchlets: lvs. dimorphic, grayish green. Var. **dumòsa,** Carr. Dense shrub, forming a rounded pyramid, with mostly needle-shaped, bright green lvs. Var. **elegantíssima,** Hort. Tips of young branchlets golden yellow. Var. **glaùca,** Carr. Vigorous-growing form, with glaucous foliage. Var. **globòsa,** Beissn. Compact globose form with bright green scale-like foliage. Var. **péndula,** Carr. With spreading limbs and slender, pendulous branches: lvs. usually scale-like. Var. **plumòsa,** Hort. A graceful pyramidal form with needle-shaped lvs., the tips whitish (var. *plumòsa álba* or *plumòsa argéntea,* Hort.), or pure white (var. *plumòsa nívea,* Schwendt.). Var. **pyramidàlis,** Carr. Dense, columnar form, with the foliage glaucous (var. *pyramidàlis glaùca*) or bright green (var.

pyramidàlis víridis). Var. **réptans,** Beissn. Low shrub, with horizontally spreading, procumbent branches and slender, curving branchlets: bright green. M.D.G. 1896:296. Probably the same as var. *horizontalis*, Arb. Kew. Var. **Schóttii,** Beissn. A dwarfish, dense, pyramidal form, with bright green and rather light foliage. Var. **tripartìta,** Beissn. A dwarf, spreading form of irregular habit, densely branched, with acicular, glaucous lvs. F.E. 33:15. Var. **venústa,** Hort. (*J. venústa*, Ellwanger & Barry). A columnar form with glossy dark green, scale-like foliage.—The dwarf forms are often very similar to *J. Sabina* and hard to distinguish without frs. except by the strong, disagreeable odor of the bruised branchlets of the latter.



2025. The two kinds of red cedar leaves. (Natural size)

17. **scopulòrum,** Sarg. Closely allied to the preceding; chiefly distinguished by the somewhat larger fr., ripening not until the second year; by its habit, forming a broad head with stout, spreading branches and often dividing into several sts. near the base, and by its shredding bark. The branchlets are somewhat shorter and stouter, and the foliage usually glaucous or yellowish green. Brit. Col. to Calif. in the Rocky Mts. G.F. 10:423. S.S. 14:739.

GG. *Trees tender.*

18. **Lucayàna,** Brit. (*J. austràlis*, Pilger. *J. barbadénsis*, Auth. *J. virginiàna* var. *Bedfordiàna*, Veitch, not Linn. *J. virginiàna* var. *barbadénsis*, Gord.). Tree, to 50 ft., with spreading branches and slender pendulous 4-angled branchlets: lvs. light green, closely appressed, ovate, sharp-pointed, glandular: fr. globose, about ⅛in. thick, dark blue, bloomy, 1–2-seeded. S. Ga. to Fla., Jamaica, Cuba, Bahamas, Haiti. S.S. 14:738.—One of the most beautiful of the junipers, often planted for ornament in the Gulf States, and in the W. Indies.

19. **barbadénsis,** Linn. (*J. bermudiàna*, Linn.). Tree, to 40 ft., in habit much like *J. virginiana*, but branches much stouter and foliage pale bluish green: branchlets thickly set, quadrangular, stout and short: lvs. mostly imbricate, thick or acicular, spiny-pointed, rigid, erect-spreading: staminate catkins larger: fr. usually 2-seeded and depressed-globular. Bermuda, Barbadoes, Antigua. G.C. II. 19:657. G.F. 4:295.

CC. *Fr. pendulous, on curved peduncles, small: shrubs, usually spreading or procumbent.*

20. **Sabìna,** Linn. Spreading or procumbent shrub, rarely with erect st. to 10 ft.: branchlets rather slender, of a very strong, disagreeable odor when bruised: lvs. needle-shaped, acute and slightly spreading or imbricate, oblong-rhombic, obtuse or subacute, usually dark green: fr. ⅕–¼in. thick, globular, 1–3-seeded. Mountains of Cent. and S. Eu., W. Asia, Siberia, N. Amer.—Very variable. The most remarkable varieties are the following: Var. **fastigiàta,** Beissn. Erect shrub of columnar habit, with dark green, mostly imbricate lvs. Var. **cupressifòlia,** Ait. (var. *hùmilis*, Endl.). Procumbent, with ascending thickish branchlets: lvs. usually imbricate, scale-like, often bluish green. Var. **tamariscifòlia,** Ait. (*J. sabinoìdes*, Griseb.). Procumbent or ascending, rarely erect: lvs. usually all needle-shaped and often in 3's, slightly incurved, dark and bright green, with a white line above. Mountains of S. Eu. G.W. 1, p. 304. Var. **variegàta,** Beissn. Branchlets variegated with creamy white: lvs. mostly imbricate.

21. **horizontàlis,** Moench (*J. prostràta*, Pers. *J. Sabìna* var. *procùmbens*, Pursh. *J. rèpens*, Nutt.). Procumbent, usually with long trailing branches furnished with numerous short branchlets, sometimes to 4 ft. high and with spreading branches: lvs. of young plants subulate, mature foliage imbricate, scale-like, acute or acutely cuspidate, bluish green or steel-blue: fr. about ⅓in. across, blue, slightly glaucous, on a pedicel shorter than its length. Nova Scotia to Brit. Col., south to Mass., N. Y., Minn. and Mont. B.B. (ed. 2) 1:67. Var. **Doúglasii,** Hort., is a distinctly trailing form with steel-blue foliage, turning purple in autumn with glaucous bloom; also called Waukegan juniper.

J. conférta, Parl.=J. litoralis.—*J. davùrica*, Pall. Allied to J. Sabina. Procumbent, with slender, spreading or drooping branchlets: fr. 1–4-seeded, small. Siberia.—*J. flàccida*, Schlecht. Graceful tree, to 30 ft., with spreading branches and slender, remote, pendulous branchlets: lvs. acute, with spreading tips: fr. globular, 5–10-seeded. Texas, Mex. S. S. 10:519.—*J. fœtidíssima*, Willd. Allied to J. excelsa. To 12 ft. high: branchlets thicker: lvs. with spreading apex, mucronate, usually eglandular: fr. larger, 1–2-seeded. Greece, W. Asia.—*J. formosàna*, Hayata (J. taxifolia Parl., not Hook. & Arn. J. oblongo-pendula, Hort.). Allied to J. rigida. Tree, to 40 ft.: lvs. rigid, spiny-pointed, with 2 white bands above, ½–1 in. long: fr. ovoid, orange, ½in. across. Formosa, Cent. & W. China. Has proved hardy at the Arnold Arboretum; the true J. taxifolia, Hook. & Arn. is not in cult.—*J. litoràlis*, Max. (J. conferta, Parl.). Allied to J. rigida, but prostrate, with long, trailing branches: fr. larger. Japan.—*J. macrópoda*, Boiss. Allied to J. excelsa. Shrub or small tree, to 30 ft., sometimes procumbent: lvs. closely appressed: fr. nodding, globular, 4-seeded. Persia to Himalayas.—*J. megalocárpa*, Sudworth. Allied to J. californica. Tree 30–50 ft. with a single trunk: lvs. in 3's, acute: fr. ½in. across or slightly more, 1–2-seeded. Ariz.—*J. mexicàna*, Schiede. Pyramidal tree: branchlets numerous, short and rather stout: lvs. acute, loosely appressed: fr. 2–4-seeded. Mex.—*J. mexicàna*, Schlecht.=J. tetragona.—*J. monospérma*, Sarg. (J. occidentalis var. monosperma, Engelm.). Closely allied to J. occidentalis. Branchlets more slender: lvs. usually opposite and eglandular: fr. smaller and usually 1-seeded. Rocky Mts., from Colo. to New Mex. S.S. 10:522.—*J. oblóngopéndula*, Hort.=J. formosana.—*J. pachyphlœa*, Torr. Tree, to 60 ft. allied to J. occidentalis, with broad, pyramidal or round-topped head: lvs. usually opposite, glandular, bluish green: fr. dark reddish brown, bloomy, with 3–4 seeds. Has a checkered bark like a black-jack oak. Colo. to Texas and New Mex. S.S. 10:520.—*J. Pinchotii*, Sudworth. Allied to J. californica. Small tree to 20 ft., usually with several sts.: branchlets rather slender: lvs. usually in 3's, appressed, sharply pointed, yellowish green: fr. globose or ovoid, ¼in. long, red, 1–2-seeded. Texas. B.T. 110.—*J. Pseùdo-sabina*, Fisch. & Mey. Allied to J. Sabina. Erect shrub, with thick, dense and short branchlets: lvs. usually dimorphic: fr. ovate, blackish, glossy, 1-seeded. Siberia.—*J. sabinoìdes*, Endl.=J. thurifera.—*J. sabinoides*, Nees=J. tetragona.—*J. sabinoìdes*, Griseb.=J. Sabina var. tamariscifolia.—*J. saltuària*, Rehd. & Wilson. Allied to J. Pseudo-sabina. Tree to 40 ft.: lvs. dark green, dimorphic, those of the lateral branches scale-like, obtusish, of the shoots in 3's, acute: fr. erect, ovoid, ¼in. long, 1-seeded. N. W. China.—*J. Sánderi*, Hort.=Chamæcyparis obtusa var. ericoides.—*J. taxifólia*, Parl.=J. formosana.—*J. tetrágona*, Schlecht. Allied to J. occidentalis. Small tree, to 20 ft., rarely to 40 ft., with round-topped or pyramidal head and slender, quadrangular branchlets: lvs. obtuse, usually eglandular: fr. subglobose, mostly 1-seeded. Texas to Mex. S.S. 10:523.—*J. thurífera*, Linn. Shrub or tree, to 40 ft., with round-topped head and spreading branches: branchlets slender: fr. globular, 2–3-seeded. Spain, Algeria.—*J. utahénsis*, Lemm. (J. californica var. utahensis, Engelm.). Bushy tree, rarely more than 20 ft., with broad, open head: branchlets slender: lvs. obtuse, light yellowish green: fr. usually 1-seeded. Colo. to Calif., west to Utah. S.S. 10:518.

ALFRED REHDER.

JURÌNEA (named for Louis Jurine, 1751–1819, professor of medicine). *Compósitæ.* Herbs or subshrubs, one of which is offered for the wild garden: lvs. gray or white-tomentose beneath or on both sides, pinnate or entire, unarmed: fls. purple: achenes 4–5-sided, seldom compressed, crowned with a pappus of unequal rough hairs.—Over 50 species from Cent. and

S. Eu., N. W. Afr., to Cent. Asia. None of the species is of great horticultural value, although sometimes cult. They thrive in any ordinary garden soil and are prop. by seeds or division of the roots in spring. **J. alàta,** Cass. Height 3–4 ft.: perennial, or according to Boissier, biennial: st. erect, winged below, 1–1½ ft. high: radical lvs. 6 in. long, oblong and lyrate, nearly glabrous above and canescent beneath: st.-lvs. lanceolate, sinuate-dentate, decurrent: heads hemispherical, long-peduncled, the involucre-bracts narrow-linear and the outer ones short-mucronulate and the apex spreading; florets purplish blue: achene 4-angled and muricate, the pappus exceeding it. Caucasus. J.H. III. 66:442. While *J. alata* is definitely described as biennial and as reaching a height of 18 in. in cult., the plant grown under this name, and which is apparently correctly determined, is said to be perennial and to grow 3–4 ft. high, having a silvery aspect in the foliage. L. H. B.

JUSSIÆA (Bernard de Jussieu, 1699–1777, who laid the foundations of a modern natural system of the vegetable kingdom). Also written *Jussieua. Onagràceæ.* PRIMROSE WILLOW. This genus includes one or two herbs that are more or less cultivated, one at least as a water plant.

Herbs, shrubs or even tree-like plants, with alternate usually entire but sometimes serrate mostly narrow lvs., and sometimes more or less showy axillary or solitary white or yellow fls.: calyx tubular with 4–6 acute persistent lobes; petals 4–6, spreading, inserted on margin of the disk; stamens 8–12 in 2 rows, inserted with the petals; ovary 4–5-celled, style simple, stigma 4–6-lobed: fr. a terete, angled or costate, dehiscent, many-seeded caps.—Species about 50, widely distributed in temperate and warm regions, but most abundant in S. Amer.; some are native in the U. S.

The horticultural interest in this genus, in this country, centers about the plant known in the trade as *J. longifolia,* a summer-flowering aquatic herb, and differing somewhat from the botanical description given below. The stems of young seedlings are four-winged, and a specimen before the writer of a plant of the previous season is five-winged. The main root of these old plants may be tuber-like, 3 inches long, ½inch thick, or 8 to 10 inches long and more slender. Also the lower leaves, at least, are opposite.—*J. longifolia* is best treated as a tender annual. The seed may be sown in fall or spring in shallow water, using seed-pans or pots, as with other flower seeds. Cover the seed, which is very fine, with finely sifted soil, place the pot or seed-pan in water, but do not submerge until the second day, when the seed will be thoroughly soaked and will not float on the surface of the water. When the plants attain a few leaves they should be potted, singly, into thumb-pots, and later into 3-inch pots, and from these planted into their summer quarters. It is not absolutely necessary to keep these plants always submerged in water after potting. The plants will do well on a bench, which should be covered with sand or ashes and the plants kept well watered. (Wm. Tricker.)

longifòlia, DC. Erect, glabrous: st. 3-angled: lvs. sessile, lanceolate-linear, acuminate at both ends, glandular beneath at the margins: pedicels 1-fid., longer than the ovary, and bearing 2 bractlets at the apex: petals 4, obovate, scarcely notched at the apex; stamens 8. Brazil.—It is not clear whether this is the plant that is listed as *J. longifolia.*

Sprèngeri, Hort. Evergreen prostrate perennial, somewhat soft-hairy, much branched, the st. winged: lvs. opposite, crowded, ovate and acute: fls. very large, canary-yellow. Argentina.—Offered abroad (Sprenger, Naples); said to be one of the most beautiful aquatic plants and that it grows equally well if grown as a terrestrial subject. L. H. B.†

JUSTÍCIA (James Justice, a Scotch gardener and author of the eighteenth century). *Acanthàceæ.* Greenhouse plants, grown for the showy fascicles, spikes or panicles of white, violet or red bracted flowers.

Mostly herbs of various habit, with opposite entire lvs: calyx deeply divided into 4 or 5 narrow lobes; corolla 2-lipped, the straight or curved tube very short and dilated above, the upper lip erect or incurved and concave and the summit entire or somewhat 2-toothed, the lower lip 3-lobed and spreading; stamens 2 attached in the throat; staminodia none; disk ring-like or cupulate: caps. ovate or oblong, with seeds 4 or less.—Species 250–300, widely distributed in many warm regions, in Amer. reaching as far north as Texas. From Jacobinia, close garden ally, the genus is distinguished by the spurred or appendaged anthers. Justicia is variously understood. Lindau (in Engler & Prantl, Pflanzenfamilien) refers no less than 30 genera to it, among others being Adhatoda and Dianthera. Most of the garden plants known as justicias are jacobinias. Consult Jacobinia, for example, for *Justicia magnifica, J. carnea, J. Pohliana, J. velutina, J. Mohintlii, J. coccinea, J. Ghiesbreghtiana* and *J. Lindenii.* Others may belong to Thyrsacanthus, Dædalacanthus and Schaueria; and there has been confusion even with Whitfieldia.

The remarks on culture under the different species of jacobinias will apply here. Plants are secured readily from cuttings made in late winter or spring, and these should bloom the coming fall or winter. After blooming, discard the plants, except such as are to be kept for furnishing cuttings. Unless well headed back, old plants become loose and weedy, and they take up too much room.

The *Justicia quadrifida* now offered in S. Calif., is probably **Anisacánthus virgulàris,** Nees (*Justícia virgulàris,* Salisb. *J. coccínea,* Cav., not Aubl. *J. quadrífida,* Vahl. *Drejèra pubérula,* Torr.). Plant vigorous, rather straggling, with long erect branches, glabrous: lvs. deciduous, light green, opposite and decussate, elliptic-lanceolate, spreading, rigid: fls. scarlet-red (or orange-scarlet), usually solitary, axillary in one of the 2 opposite axils, thus making a long leafy unilateral spike; corolla-tube long and slender, deeply lobed into 4 spreading or recurved parts. Mex. R.H. 1872:50. Autumn and winter in S. Calif., Aug. and Sept. in France. Var. **compácta,** Franceschi, is a very compact low bush of emerald-green color and covered all summer with orange-scarlet fls.; comes true from seed.—Not to be confounded with *Justicia quadrifaria,* Wall.

Of the justicias appearing in American lists, only **J. furcàta,** Jacq. (*Adhàtoda furcàta,* DC.) seems now to be retained in the genus. Herbaceous, pubescent, the st. erect and terete: lvs. oblong-oval, attenuate to petiole: fls. small, in short aggregated axillary spikes which are often geminate, the bracts linear-lanceolate; color of fls. purple and white; upper lip 2-fid, the lower 3-fid and broad-convex. S. Mex.—Said to seed itself freely in S. Calif., but to be of little value.

J. callètricha and *J. calycòtricha,* Hort., see Schaueria.—*J. flàva,* Hort., and *J. flavicoma,* Lindl.=Schaueria. L. H. B.

JUTE is a fiber plant, of easy culture in warm climates. It has been successfully grown in the Gulf States, but the want of suitable machines for separating the fiber is the great obstacle which prevents the growth of the jute-fiber industry in America. See *Corchorus;* also "Cyclopedia American Agriculture," Vol. II.

K

KADSÙRA (Japanese name). *Magnoliàceæ.* Tropical Asian woody climbers. Kadsuras have leathery or rarely membranous foliage: fls. axillary, solitary, whitish or rosy, unisexual; sepals and petals 9–15, gradually changing from the outermost and smallest to the innermost and petaloid; staminate fls. with an indefinite number of stamens, which are separate or coalesced into a globe: carpels indefinite in number, 2–3-ovuled: mature berries in globular heads.—About 8 species, of one of which Charles S. Sargent writes (G.F. 6:75): "The flowers are not at all showy, but it is a plant of extraordinary beauty in the autumn when the clusters of scarlet fruit are ripe, their brilliancy being heightened by contrast with the dark green, lustrous, persistent leaves. . . . It might well be grown wherever the climate is sufficiently mild, as in the autumn no plant is more beautiful."

japónica, Linn. Small, procumbent, warty shrub: lvs. oval or oblong-oval, thick, serrate: peduncles 1-fld., solitary. Japan, as far as 35° north latitude.—The type is advertised by Japanese dealers; also a variety with foliage blotched with white, and another with foliage margined white.

KAEMPFÈRIA (Engelbert Kaempfer, 1631–1716, traveled in the Orient, and wrote on Japan). *Zingiberàceæ.* Tuberous- or fleshy-rooted plants, grown for foliage and flowers.

Often stemless or apparently so, the few lvs. aggregated at the base and sometimes distichous on the st.: lvs. mostly broader than lanceolate: fls. in a bracted tuft or small cluster in the center of the lf.-clump, or in a peduncled raceme, often large and showy, white, yellow, violet or purple; calyx cylindrical or funnelform, toothed; corolla tubular, exserted, with narrow lobes; staminodia petal-like and the showy parts, one of them being a broad lip; fertile stamen 1.—More than 50 species in Trop. Asia and Afr. Schumann, Engler's Pflanzenreich, hft. 20 (1904). For cult. see *Hedychium* and *Zingiber.*

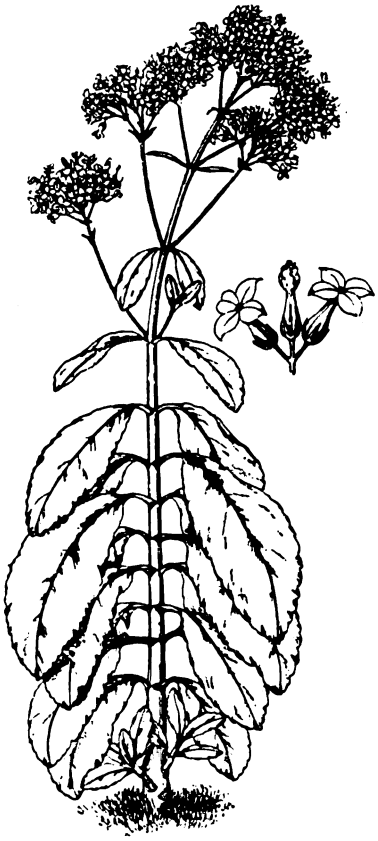
A. *Foliage margined with white.*

Gilbertii, Bull. Stemless, fleshy-rooted: lvs. oblong-lanceolate, deep green, bordered white, wavy at the margin: fls. purple and white. E. Indies. G.C. II. 17:713. R.B. 21:169. S.H. 2:131. G.Z. 27, p. 217.—Intro. by W. Bull, 1882. Reasoner Bros. cult. this outdoors in S. Fla., and say, "The fls. are borne on ornamental crimson heads rising from the ground on separate stalks, and resembling in outline small pineapple frs. These heads retain their beauty all summer."

AA. *Foliage not margined with white.*

B. *Lvs. tinged purple beneath.*

rotúnda, Linn. Stemless, tuberous: lvs. not produced until after the fls., oblong, erect, petioled: corolla-segms. long-linear; staminodes oblong, acute, white, 1½–2 in. long; lip lilac or reddish, deeply cut into 2 suborbicular lobes; anther-crest deeply 2-fid: petiole short, channelled; blade 12 in. long, 3–4 in. wide, usually variegated with darker and lighter green above and tinged purple beneath: spikes 4–6-fld., produced in March and April. India. B.M. 920 and 6054. R.B. 25:181.



2026. Kalanchoe carnea. (Plant ×⅛)

BB. *Lvs. not tinged purple beneath.*

Kirkii, Schumann (*Cienkówskya Kirkii,* Hook. f.). Lf.-st. 3–4 in. long: lvs. about 4, crowded at the apex of the st., oblong, acute, 8–9 in. long, 2½–3 in. wide at the middle: flowering sts. short, slender, 1-fld.; corolla-lobes oblong-lanceolate, 1 in. long; staminodes more than twice as long as the corolla-lobes, pale rose-purple; lip rounded at the apex, slightly notched, 2 in. broad, with a yellow mark at the throat. Trop. Afr. B.M. 5994. I.H. 30:495. G.W. 2, p. 253. Var. **elàtior,** Stapf. Taller: lvs. longer, the base long-attenuate, the petiole longer: lip bright rose, with a yellow blotch bordered by purple marking. Rhodesia. B.M. 8188.

K. lùtea, C. H. Wright. Stemless: lvs. 3 or 4, about 9 in. long, oblong, green and glabrous above but paler and pilose beneath: scape 3½ in. high; bracts about 8, rounded and green; fls. yellow, the lip entire and orange-yellow. Penang (India).—*K. rósea,* Schweinf. Much like K. Kirkii, but said to be more beautiful: rootstock short and fleshy, with many cord-like roots: lvs. about 18 in. long, the blade bright green and plaited: scape 18 in. high, bearing about 6 fls. to many, which are above 2 in. across, brilliant rose-red and open one at a time, with an orange-blotched throat. Cent. Afr.

WILHELM MILLER.
L. H. B.†

KAFIR or K. CORN: *Sorghum.*

KAGENÉCKIA (F. v. Kageneck, an Austrian minister to Spain). *Rosàceæ.* Very few species of tender small evergreen trees from Chile and Peru, one of which has been grown in S. Calif. but now is probably lost to cult. in this country. The fls. are white, 5-petaled, about ¾in. across, and unisexual. The male fls. are borne in racemes or corymbs; the females are solitary; all are terminal: lvs. leathery, serrate, stalked: stamens 16–20, inserted on the mouth of the calyx, in 1 series: carpels 5, free: ovules numerous.

oblónga, Ruiz & Pav. Lvs. oblong, acuminate at both ends, the serrations obtuse and rather callous. Chile. B.R. 1836 (as *K. cratægifolia*). L. H. B.

KAKI: *Diospyros* and *Persimmon.*

KALÁNCHOË (from Chinese name). *Crassulàceæ.* Sometimes spelled *Calanchoë.* Succulent glasshouse herbs or subshrubs, with interesting foliage and flowers.

Usually robust erect plants: lvs. opposite, fleshy, sessile or stalked, varying from entire to crenate and pinnatifid: fls. yellow, purple or scarlet, in many-fld.

terminal paniculate cymes, rather large and often showy; calyx 4-parted, the narrow lobes shorter than the corolla-tube, usually falling early; corolla 4-parted and mostly spreading, the tube usually urn-shaped; stamens 8: carpels, 4.—More than 100 species, in the Old World tropics and in S. Afr., and 1 reported from Brazil. A few species are prized by amateurs. The fls. are lasting in bouquets. For the general handling of this class of plants, see *Succulents;* also *Cotyledon* and *Crassula.* They prop. readily by seeds and cuttings.

A. *Fls. of the red, scarlet, orange, yellow series.*

coccínea, Welw. Somewhat hairy above, 2–4 ft. tall: lower lvs. ovate, obtuse, coarsely crenate-dentate, stalked; upper lvs. linear-lanceolate, obtuse, sessile: fls. scarlet or orange, on short pedicels, in broad forking panicles which have stalks about 1 ft. long; calyx pubescent, the segms. lanceolate, acute; corolla-tube ½in. long, the limb ½in. across, and the segms. deltoid-ovate, acuminate and glabrous or pubescent. Trop. Afr.

Kirkii, N. E. Br. St. 2–4 ft., simple or branched, more or less glandular-pubescent: lower lvs. soft-fleshy, pubescent, oblong to lanceolate, about 4 in. or less long, the petioles to 2 in. long, irregularly crenate-dentate; uppermost lvs. linear-cuneate, nearly or quite entire: fls. brilliant orange-scarlet, in large corymbose cymes; calyx-lobes or sepals (free to base) oblong, acute, green, glandular-pubescent; corolla-tube ⅓in. long, yellowish green, thinly glandular-pubescent; lobes about ¼in. long, elliptic, scarlet-orange, red on the back. Trop. Afr. R.H. 1914, p. 21. M.D.G. 1908:521.

flámmea, Stapf. A foot to 18 in. high, glabrous, little branching: lvs. ovate-oblong, obtuse, narrowed into a short petiole (blade about 2 in. long and 1¼–1½ in. wide), fleshy, obscurely crenate-dentate or almost entire: fls. yellow and orange-scarlet, ½in. across; calyx parted to the base, the segms. linear-lanceolate and somewhat acute; corolla-tube 4-angled, less than ½in. long, yellowish; lobes ovate-acute, orange-red. Trop. Afr. B.M.7595. G.C. III. 26:47.—Thrives in a comparatively cool greenhouse.

glaucéscens, Brit. St. glabrous, terete, 2 ft. or more, sometimes with long ascending pubescent branches which are nearly leafless below: lower lvs. narrow-ovate, obtuse and irregularly crenate, 5 in. long, narrowed to clasping petioles: infl. glaucous, being a di- or trichotomous panicle; fls. red or dark yellow, sometimes on few-fld. peduncles from the upper nodes; calyx-lobes lanceolate, acute or nearly so, short; corolla-tube ½in. long, bearing short narrow-ovate acute segms. Trop. Afr.

crenàta, Haw. St. glabrous, or somewhat hispid in the upper part, 2–6 ft. high from a thick fibrous root: lvs. oblong or roundish ovate or spatulate, 2–3 in. long, coarsely crenate, obtuse: infl. of many-fld. axillary and terminal cymes; fls. bright yellow or orange; calyx-lobes glabrous or hispid-viscid, lanceolate and acute, only slightly joined at base; corolla-tube ½in. long, glabrous or pubescent; lobes acute, oblong-lanceolate. Trop. Afr. B.M. 1436 (as *Cotyledon crenata*).—*K. crenàta,* Hamet = *Bryophyllum crenatum.*

2027. A Norfolk kale field at the Christmas harvest time.

rotundifòlia, Haw. St. glabrous, slender, 1–3 ft., leafy below: lvs. roundish obovate, obovate or spatulate, nearly entire or crenulate, somewhat petioled, the lower ones 1–2 in. long: infl. of panicled trichotomous flat-topped cymes; fls. orange or deep yellow; calyx small; corolla small (less than ½in. long), the lobes narrow-lanceolate and acute. S. Afr.

AA. *Fls. pink.*

cárnea, Mast. Fig. 2026. Sts. simple, 2 ft. or less, glabrous: lvs. oval or obovate, obtuse, crenate-dentate, narrowed into a short petiole, the upper ones nearly linear and sessile: fls. light rose or pink, very fragrant, nearly ½in. across; calyx parted to the base, the segms. linear-pointed; corolla-tube swollen at base and 2–3 times longer than calyx: corolla-lobes broad-oval, acute. S. Afr. G.C. III. 1:211. G.F. 3:53 (reduced in Fig. 2026).—Good winter bloomer, prop. by seeds or cuttings. Seeds sown in spring give blooming plants for following Christmas.

AAA. *Fls. white or white-yellow, very long.*

marmoràta, Baker (*K. grandiflòra,* Rich., not Wight). St. stout and branching: lvs. large (6–8 in. long), obovate, narrowed to a short broad petiole, crenate, blotched with purple: fls. long and tubular (3 in. or more long), creamy white or yellowish, the lobes ovate-acuminate. Abyssinia. B.M. 7333. I.H. 43, p. 45.—Interesting pot-plant, with large trusses of erect fls.

Any number of kalanchoës may appear in the collections of fanciers. Following are some of the more recent kinds, which may not be found in the regular manuals: *K. angolénsis,* N. E. Br. Lvs. fleshy, to 4 in. long and half as broad: fls. bright yellow and numerous, variable in the number of its corolla-lobes. Trop. Afr.—*K. Béntii,* C. H. Wright. St. 3 ft., unbranched, nearly 1 in. diam.: lvs. about 6 pairs near top of st., rigid and subcylindrical, 3–6 in. long: fls. white, in a loose erect panicle; calyx-lobes fleshy and spreading; corolla 1½ in. long, 4-angled, inflated at base, the limb nearly 1 in. across. Arabia. B.M. 7765.—*K. divérsa,* N. E. Br. St. 1½–2 ft. high: lvs. lanceolate to elliptic-ovate, to 5 in. long, toothed, glabrous: fls. with a green tube ½in. long and vermilion-orange shorter lobes. Somaliland.—*K. Dyeri,* N. E. Br. A fine species, 2–2½ ft. high, glabrous: lvs. elliptic and spreading, 4–7 in. long, coarsely toothed, petiole to 3 in. long: infl. corymbose-cymose, to 1 ft. long; fls. with a pale green tube 1½ in. long, and a pure white spreading limb of lanceolate-acute lobes 1 in. long. Trop. Afr. B.M. 7987.—*K. Elizæ,* Berger. St. simple, about 8 in.: lvs. oblong, nearly 4 in. long, entire: fls. red, in axillary thyrse-like panicles; corolla almost 2-lipped, the tube nearly 1 in. long, the lobes linear and acute and about ½in. long. Trop. Afr.—*K. felthaménsis,* Hort., is a hybrid of K. flammea and K. Kirkii.—*K. kewénsis,* Hort., is a hybrid of *K.* Bentii and K. flammea.—*K. latisépala,* N. E. Br. Related to K. Dyeri, but lvs. sessile and fls. about half the size: st. about 2 ft.: lvs. obovate, 4–5 in. long: fls. white, in many-fld. terminal cymes; corolla-tube 1¼ in. long; lobes ½in. long, ovate or elliptic-ovate. Trop. Afr.—*K. Lúciæ,* Hamet. St. stout, simple, erect: lvs. sessile, obovate or obovate-spatulate, 1–3 in. long: fls. (color not given) in a panicle-like cluster, the corolla urn-shaped and the segms. shorter than tube. Transvaal.—*K. mágnidens,* N. E. Br. St. 2½ ft. or more, glabrous, green and with no bloom: lvs. petioled, 3½ in. or less long, the lower elliptic-ovate and with 3 or 4 large teeth either side: infl. loosely branched, the ultimate cymes com 9–25-fld.; corolla light salmon, the tube somewhat less than long. Uganda (Trop. Afr.).—*K. prasina,* N. E. Br. Small, small and not attractive fls.: sts. leafy, about 1½ in. long: obovate or spatulate-obovate, 2–3 in. long, entire, or obscu crenate: fls. with a green tube less than ¼in. long, and short w lobes with greenish center. Trop. Afr.—*K. somaliénsis,* Ba Erect, shrubby: lvs. obovate or oblong-obovate, 4–6 in. l toothed: fls. in a loose cyme to 10 in. long, white faintly tinged low; corolla-tube 2½ in. long; lobes ovate-lanceolate. Somalila —*K. sexangulàris,* N. E. Br. St. 6-angled, simple and strai about 3 ft. high: lvs. stalked, the lower ones elliptic or suborbicu about 3 in. long: fls. small, yellow, in a panicle about 8 in. lo Probably Transvaal.

L. H. B.

KALE (*Brassica oleracea* var. *acephala*). Figs. 20 2028. This plant and the so-called Georgia collard a without doubt more closely akin to the wild cabbage Europe than any of the other cultivated forms of Bra

sica. Kale is really a non-heading cabbage. It is hardy and enjoys the cool portion of autumn and early spring for its growth. It ranks low in quality, but because it is hardy and will stand the winters of the Atlantic seaboard states south of New York, it supplies a cheap and palatable pot-herb during the winter season.

2028. Kale.—Leaf of Scotch Curled.

Commercially kale is extensively grown in only two districts, namely, in the vicinity of Norfolk, Virginia, and on Long Island, New York. This restricted commercial area is undoubtedly due to economic rather than soil or climatic conditions. The fact that it is a coarse, light, low-priced commodity in greatest demand from December to April restricts its profitable extensive culture to regions possessing peculiar climatic and transportation conditions,—that is, mild winters, a relatively short haul, and reasonable transportation rates.

There are several forms of kale, but only two are extensively grown for market,—Scotch kale and blue kale. Scotch kale forms by far the greater bulk of the plantings in the Norfolk area, but because the blue kale is considered hardier it is often used for late plantings and by those who have been delayed in seeding their crop.

While kale can be started under cover and transplanted with as great ease and certainty as cabbage, it is seldom handled in this way outside the kitchen-garden. Under field conditions the land is prepared the same as for cabbage, by liberal fertilizing and thorough plowing and harrowing. The seed is usually planted in drills 3 feet apart and later thinned, by chopping out, to a stand of individual plants about 6 inches apart in the row. In the Norfolk area, the seeding is done between August 15 and 20 and if the plants grow vigorously they are often harvested to meet early market demands in such a way as to accomplish the work of further thinning. The main crop is harvested by cutting the thick whorl of leaves that forms the crown of the plant. These are packed for market either in barrel-high Delaware baskets or in veneer barrels. The kale is pressed firmly as it is filled into the receptacle. The barrels are then covered by a clean burlap drawn over the mass piled on top of the barrel and held in place by driving down the loose top hoop.

Kale requires somewhat less fertilizer than cabbage, is less expensive to produce, usually produces an abundant crop which can be harvested at small cost and with a fairly satisfactory net profit an acre. The yields vary from 200 to 400 barrels to the acre with an average of about 250 barrels. The price ranges all the way from 50 cents to $2 a barrel. As usually handled, kale is not at its best. It is not economically possible to produce high-grade kale. Good kale is young tender kale which yields only a small crop to the acre. For the amateur, however, high-quality kale is possible, for he can handle it so as to secure the quick growth of young tender plants, which insures quality. The commercial grower must fill barrels if he is to find profit.

L. C. CORBETT.

KALE, SEA: *Crambe maritima*, treated under *Sea-Kale*.

KÁLMIA (after Peter Kalm, Swedish botanist, traveled from 1748 to 1751 in North America). *Ericàceæ*. AMERICAN LAUREL. Ornamental shrubs grown for their handsome flowers and foliage.

Evergreen, rarely deciduous: lvs. alternate or opposite, short-petioled, entire: fls. in terminal or lateral corymbs or umbels, rarely solitary; calyx 5-parted; corolla saucer-shaped or broadly campanulate, 5-lobed; stamens 10, with slender filaments, the anthers held back in little pouches of the corolla, springing up suddenly and discharging the pollen if touched; ovary 5-celled, superior: caps. globular, parting into 5 valves, with numerous minute seeds.—Seven species in E. N. Amer. and Cuba. The lvs. of the kalmias are said to be poisonous to animals, especially those of *K. angustifolia*. The fl. of Kalmia is one of those proposed as a national floral emblem, especially on account of the exquisite symmetrical beauty of the single blossom. Kalmia is a purely American genus, but unfortunately it is popularly known only in the eastern states.

The kalmias are medium-sized or low shrubs, very rarely small trees with purple, pink or nearly white, cup-shaped flowers in showy terminal corymbs or in axillary umbels, rarely solitary, followed by small capsular fruits. *Kalmia angustifolia* and *K. polifolia* are hardy North, and also the most ornamental member of the genus, *K. latifolia*, which next to rhododendron is the most beautiful flowering hardy evergreen. Massed in groups or as single specimen on the lawn, it is one of the most decorative plants when covered with its abundant pink flowers. Even small plants produce flowers. The foliage is very decorative, contrasting well with the red and yellowish branches. The species is easily forced and makes a very handsome pot-plant. The other species are pretty border plants for evergreen shrubberies.

The kalmias thrive well in a sandy, peaty or loamy soil, but dislike clay and limestone. They grow almost as well in swamps as in drier locations and prefer partly shaded situations, but thrive well also in sunny places, provided there be sufficient moisture. They require generally almost the same treatment as the hardy rhododendron, but are less particular about soil and

2029. Kalmia latifolia. (×½)

position. Transplanting, if carefully done either early in fall or in spring, is not difficult; a mulching the first season after planting will be of much advantage to keep the roots from drying in summer and from frost in winter. Propagation is usually by seeds sown in sandy, peaty soil in pans or boxes in early spring and

2030. Kalmia latifolia var. myrtifolia. (×½)

kept in a coldframe or greenhouse. The seedlings should be pricked off as soon as they can be handled, and after they are again established gradually hardened off and the following year transplanted in frames or beds outdoors. Varieties of *K. latifolia* are usually increased by side-grafting on seedlings in the greenhouse or by layers, since it grows less readily from cuttings, while the other species may be propagated by cuttings of half-ripened wood under glass.

A. *Fls. in umbels or corymbs.*

B. *Lvs. evergreen.*

C. *Branchlets terete: lvs. pale green beneath.*

D. *The lvs. alternate, pointed.*

latifòlia, Linn. MOUNTAIN or AMERICAN LAUREL. CALICO BUSH. Fig. 2029. Shrub, 4–10 ft. high, rarely tree to 30 ft., with dense, round-topped head: lvs. petioled, alternate or irregularly whorled, oblong or elliptic-lanceolate, acute at both ends, dark green above, yellowish green below, 3–4 in. long: fls. in large, terminal compound corymbs on viscid peduncles; corolla rose-colored to white, with purple markings within, about ¾in. across. May, June. New Bruns. to Fla., west to Ohio and Tenn. B.M. 175. Em. 443. S.S. 5:236, 237. A.F. 13:32. Gng. 1:306; 3:1; 7:289. Gn. 22:6; 27, p. 549; 33, p. 607; 52, p. 77; 61, p. 9. G.M. 51:551. G. 19:708; 21:664; 35:33, 497. F.E. 9:401. C.L.A. 3:181. A.G. 19:465. M.D.G. 1903:576–79. G.F. 3:453. Mn. 8:183. J.H. III. 51:361. Var. **álba,** Bosse. Fls. almost white. Var. **fuscàta,** Rehd. Corolla inside with a broad dark purpish brown band. Var. **myrtifòlia,** Bosse (var. *nàna* or var. *mìnor*, Hort.). Fig. 2030. Lvs. small, 1–2 in. long, deep green, of slow growth, forming a low, dense bush. G.F. 8:317 (adapted in Fig. 2030). R.H. 1883, p. 11. Gn. 29, p. 379; 33, p. 603. Var. **obtusàta,** Rehd. Of compact habit and slow growth: lvs. elliptic or oval, obtuse at both ends, 2–3 in. long. Var. **polypétala,** Nichols. (var. *monstruòsa*, Mouillef.). Fig. 2031. Corolla divided into 5 narrow petals which gives to the fls. a feathery appearance. G.F. 3:453 (adapted in Fig. 2031). Var. **rùbra,** Sweet (var. *Pavártii*, André). Fls. deep pink. R.H. 1888:540.

DD. *The lvs. mostly opposite or in 3's, obtuse.*

E. *Under side of lvs. glabrous.*

angustifòlia, Linn. SHEEP-LAUREL. LAMBKILL. WICKY. Shrub, to 3 ft.: lvs. petioled, usually oblong, obtuse, light green above, pale beneath, 1–2½ in. long: corymb lateral, many-fld., compound or simple; fls. ½–⅝in. across, purple or crimson; sepals ovate, glandular. June, July. From Newfoundland and Hudson Bay to Ga. B.M. 331. Em. 445.—There are varieties with light purple fls., var. **ròsea,** Hort.; with crimson fls., var. **rùbra,** Lodd. (var. *hirsùta*, Voss). L.B.C. 6:502; with white fls., var. **cándida,** Fern.; with ovate or oval lvs., var. **ovàta,** Pursh, and of dwarf habit, var. **pùmila,** Bosse (var. *nàna*, Hort.).

EE. *Under side of lvs. pubescent.*

carolìna, Small (*K. caroliniàna*, Day). Similar to the preceding, but the young parts finely pubescent: lvs. oval to oblong, obtuse, grayish pubescent below, ⅔–1¾ in. long: fls. purplish, ½in. across, in small corymbs; sepals oblong-lanceolate, puberulous. June, July. Va. to N. C. B.B. (ed. 2) 2:684.—Has proved hardy at the Arnold Arboretum.

CC. *Branchlets 2-edged: lvs. glaucous-white beneath, all opposite or in 3's.*

polifòlia, Wang. (*K. glaùca*, Ait.). Low, straggling shrub, to 2 ft.: lvs. almost sessile, oval to linear-oblong, obtuse, revolute at the margins, ½–1½ in. long: fls. in simple terminal umbels, slender-pedicelled, ½–¾in. across, rose-colored or purplish. May, June. Newfoundland to Pa. and in the Rocky Mts. from Sitka to Calif. B.M. 177. L.B.C. 16:1508. Em. 441. Var. **microphýlla,** Rehd. (*K. microphýlla*, Heller), is the alpine form of the Rocky Mts., growing only a few inches high, and with very small lvs., ½in. or less long. Var. **rosmarinifòlia,** Rehd. (*K. glaùca* var. *rosmarinifòlia*, Pursh), has narrow, linear-oblong, strongly revolute lvs.

2031. Kalma latifolia var. polypetala. (×⅔)

BB. *Lvs. deciduous, alternate.*

cuneàta, Michx. Fig. 2032. Erect shrub, with slender, straggling sts. to 3 ft.: lvs. petioled, cuneate, obovate-oblong, acute or obtuse, pubescent beneath when young, ¾–1½ in. long: fls. slender-pedicelled, in few-fld. lateral umbels, creamy white with a red band within, ½–¾in. across. June. N. C. and S. C. G.F. 8:435 (adapted in Fig. 2032). B.M. 8319.—Tender.

AA. *Fls. solitary, axillary: plant hirsute.*

hirsùta, Walt. (*Kalmiélla hirsùta*, Small). Low shrub, with many erect or ascending sts. to 1 ft.: lvs. alternate, almost sessile, oblong to lanceolate, ¼–½in. long: fls. slender-pedicelled, ½in. across, rose-purple; sepals oblong-lanceolate, hirsute, longer than the caps. June. S. Va. to Fla. B.M. 138. L.B.C. 11:1058.—Tender.

ALFRED REHDER.

KALOPÀNAX: *Acanthopanax.*

KALOSÁNTHES: *Rochea.*

KARÀTAS: *Aregelia.*

KAULFÚSSIA: *Charieis.*

KENDRÍCKIA (personal commemorative name). *Melastomàceæ.* A warmhouse root-climber from S. India and Ceylon, where the sts. "in their lower part creep up trees like ivy, hence flattened with the lvs. distichous." Species one, **K. Wàlkeri,** Hook. f., offered abroad: lvs. opposite, fleshy, stalked, oblong or obovate, obtuse, about 1½ in. long, the margins glandular-hairy and the surface dotted white: fls. "tinging the forest red" when the plants ascend to the tops of the tallest trees, borne in few-fld. umbels or solitary; calyx rose-purple, urn-shaped; corolla bright red, the 4 fleshy petals about 1 in. long; stamens 8, equal, the anthers opening at the apex by a pore and somewhat produced or extended at the base: fr. a globose caps. opening by 4–6 valves at the apex. Probably requires the treatment given other warm melastomaceous plants. See *Melastoma.*

L. H. B.

KENNÉDYA (Kennedy, of the nursery firm of Kennedy & Lee, important English nurserymen of the latter part of eighteenth century). *Leguminòsæ.* Woody trailers or twiners, making excellent plants for the intermediate house or conservatory.

Perennials, usually pubescent or villous, prostrate and trailing or climbing, the st. more or less woody: lvs. mostly pinnately 3-foliolate, sometimes with 5 lfts. or even reduced to 1, the lfts. stipellate, entire or somewhat 3-lobed: fls. papilionaceous, red to almost black, disposed in pairs, umbels or racemes, or sometimes solitary; calyx 2-lipped by the cohesion of 2 upper lobes; standard orbicular or obovate, narrowed to a claw, and bearing minute auricles; wings falcate, joined to the incurved keel; stamens 9 and 1: pod linear, flattened or cylindrical, 2-valved with pithy divisions between the seeds.—Species about a dozen, in Austral. Closely allied to Hardenbergia, but differs in the larger red or red-black rather than white or blue fls., and characters of keel and infl. These genera belong to the Phaseolus tribe.

The species are known mostly as glasshouse subjects. They propagate with ease from seeds, and also from cuttings of firm green wood; they require an intermediate temperature. Insects are likely to trouble them. They are mostly spring and summer bloomers, and should rest in winter. Give plenty of water during summer. They should be given support; they grow from 3 to 10 feet high, making stiff, woody stems. They may be trimmed back freely when at rest. The taller kinds, like *K. rubicunda* and *K. coccinea,* are excellent for rafters. *K. nigricans* is an old garden plant, still grown in this country under the name of *Lotus nigricans.* Well-rooted plants may be planted permanently in the greenhouse border.

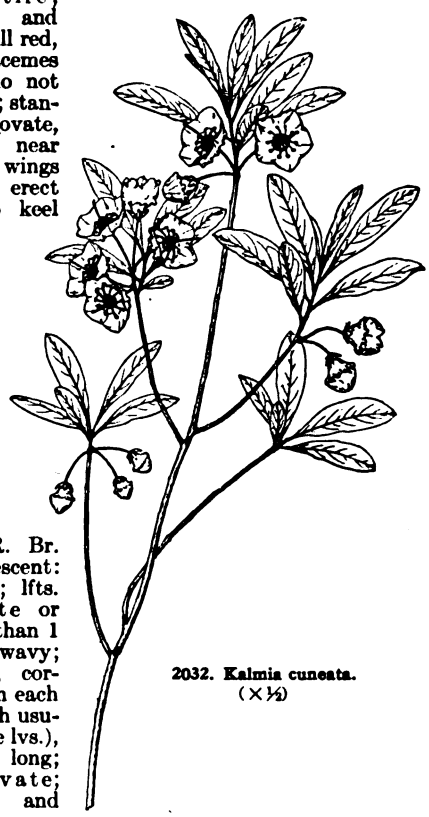
A. *Fls. nearly black.*

nígricans, Lindl. Twining, robust, somewhat pubescent: lfts. (sometimes reduced to 1) broad-ovate or rhomboid, entire, obtuse or emarginate, 2–3 in. long; stipules small and reflexed: fls. slender, 1 in. or more long, in short 1-sided axillary racemes, deep violet-purple or almost black, green-blotched on the standard which is narrowly obovate and reflexed; wings about as long as keel, and narrow: pod flattened. W. Austral. B. R. 1715. B.M. 3652.—An immense grower in S. Calif.

AA. *Fls. red or scarlet.*

B. *Standard narrow-obovate.*

rubicúnda, Vent. Pubescent, twining: lvs. 3-foliolate; lfts. 3–4 in. or more long, ovate to orbicular or ovate-lanceolate, entire; stipules small and reflexed: fls. dull red, drooping in racemes that usually do not exceed the lvs.; standard narrow-obovate, reflexed from near the middle; wings narrow and erect adhering to keel above the middle: pod flat or nearly so. L.B.C. 10:954. B.M. 268 (as *Glycine rubicunda*). B. R. 1101 (as *Amphodus ovalus*). H.F. II. 4:166.



2032. Kalmia cuneata. (×½)

BB. *Standard broad-ovate or orbicular.*

prostràta, R. Br. Prostrate, pubescent: lvs. 3-foliolate; lfts. broad-obovate or orbicular, less than 1 in. long, often wavy; stipules leafy, cordate: fls. 2–4 on each peduncle (which usually exceeds the lvs.), scarlet, ¾in. long; standard obovate; keel incurved and obtuse; wings narrow and short: pod nearly cylindrical, pubescent. B.M. 270 (as *Glycine coccinea*). J.H. III. 44:65.

Var. **màjor,** DC. (*K. Márryattæ,* Lindl. *K. Marryattiàna,* Hort.). Larger and more hairy, twining: lfts. larger, strongly undulate; stipules sometimes 1 in. across: fls. large, deep scarlet. B.R. 1790. Gn. 28:60. Gn.W. 4:505. H.U. 5, p. 139. A.F. 3:547.—A very handsome winter-flowering twiner.

coccínea, Vent. Prominently pubescent, trailing or twining: lfts. 3 or 5, ovate or oblong, very obtuse, often somewhat 3-lobed; stipules very small: fl. ½in. long, scarlet, in long-peduncled clusters of 15–20; standard orbicular; keel very obtuse, short: pod flattened. B.M. 2664. L.B.C. 12:1126.—Known under several names, as *K. inophýlla,* Lindl., B.R. 1421; *K. dilatàta,* Cunn., B.R. 1526; *Zichya tricolor,* Lindl., B.R. 25:52; *Z. villòsa,* Lindl., B.R. 28:68, and others. Handsome slender twiner or trailer.

K. audomariénsis, Hort., is probably a form of Hardenbergia monophylla, although reputed to be a hybrid between that species and K. prostrata var. major (K. Marryatæ). Fls. rosy red, in racemes: lvs. ovate-lanceolate, acuminate, petioled: handsome. R.B. 27:25.—*K. Beckxiàna*, F. Muell. Much like K. rubicunda, but peduncles 2-fld.: twining: lvs. 3-foliolate, the lfts. obovate to elliptic, to 3 in. long: fls. red with a green-yellow dark-margined blotch at base of standard, about 1½ in. long. S.W. Austral. B.M. 8358. A showy and striking plant.—*K. cærùlea*, Hort., is probably Hardenbergia Comptoniana.—*K. Comptoniàna*, Link.=Hardenbergia Comptoniana.—*K. exímia*, Lindl. Twining or prostrate, silky or becoming glabrous: lfts. 3, ovate, or obovate, not exceeding 1 in. long, very obtuse. fls. scarlet, not large, 2 or 3 more on a peduncle; standard very broadly obovate or nearly orbicular: pod usually curved. W. Austral. P.M. 16:35. H.F. 4:166.—*K. longiracemòsa*, Lindl.=Hardenbergia monophylla.—*K. macrophýlla*, Lindl.=Hardenbergia Comptoniana.—*K. ovàta*, Sims=Hardenbergia monophylla.—*K. retrórsa*, Hemsl. Twining, reddish hairy on the young growths: lvs. 3–6 in. long, 3-foliolate, petioled; lfts. oval to sub-orbicular: fls. rose-purple with white spot on standard, about ½in. across, borne in a peduncled raceme: pod retrorsely pilose. E. Austral. B.M. 8144.—*K. Stirlingii*, Lindl. Hairy, trailing or twining: lvs. 3-foliolate, ovate to orbicular, very obtuse; stipules broadly cordate: fls. scarlet, in 1–3 pairs on axillary peduncles: pod very turgid. W. Austral. B.R. 1845.

L. H. B.

KÉNTIA (after William Kent, horticulturist, companion of Reinwardt in journeys through the Indian archipelago). *Palmàceæ*, tribe *Arèceæ*. Ornamental spineless palms grown in the greenhouse.

Leaves pinnate, sharp-pointed or 2-toothed; lfts. linear-lanceolate, midnerves scaly beneath, and rachis angled above; petiole channelled above, rounded on the back. It differs from Areca in the sharply 4-angled branchlets of the spadices; and from Hedyscepe and Kentiopsis in having only 6 stamens.—Species at most 6 or 7, from the Moluccas to N. Austral. The type is *K. procera*, Blume, from New Guinea, which is not cult. It is probable that none of the kentias known to the American trade belongs properly in this genus.

K. austràlis, Hort., from Lord Howe's Island, is probably one of the four following palms which, according to Maiden in Proc. Linn. Soc. N. S. W. 1898, are the only palms on that island: Clinostigma Mooreanum, Howea Belmoreana and H. Forsteriana, and Hedyscepe Canterburyana. K. australis was intro. 1873 and advertised 1893. —*K. Baùeri*, Seem.=Rhopalostylis Baueri.—*K. Belmoreàna*, C. Moore=Howea Belmoreana.—*K. Belmoreàna*, F. Muell.=Howea Belmoreana.—*K. Brównii*, Hort. Dedicated to D. S. Brown, of St. Louis, Mo. Resembles K. Macarthuri. Lvs. pinnate, arching; lfts. truncate and premorse. Very graceful. A.G. 15:266. This is, perhaps, Nenga or Hydriastele.—*K. Canterburyàna*, F. Muell.=Hedyscepe Canterburyana.—*K. divaricàta*, Planch.=Kentiopsis divaricata.—*K. Dumoniàna*, Hort. Adv. 1895. F.R. 1:379.—*K. élegans*, Brongn. & Gris.=Cyphophœnix elegans.—*K. exhorrhìza*, Wendl.=Exhorrhiza Wendlandiana.—*K. Forsteriàna*, F. Muell.=Howea Forsteriana, considered by Bentham to be only a form of Howea Belmoreana, although horticulturists do not accept this.—*K. frutéscens*, Hort. Cult. by Siebrecht & Son.—*K. fulcita*, Brong.=Cyphophœnix fulcita.—*K. grácilis*, Hort.=Microkentia gracilis.—*K. Kerstenìana*, Hort. Lvs. very slender, dark green, arching, ascending, widely pinnated; lfts. broadly cuneate, shaped like a shark's fin, the truncate apex curiously erose, ragged, the upper margin extending into a long, sharp tip; petioles covered with light grayish brown pubescence. New Ireland. A.G. 20:223 (1899). G.C. III. 24:391. This is probably a Nenga.—*K. Lindenii*, Hort.=Kentiopsis macrocarpa.—*K. Lucìani*, Lind.=Kentiopsis macrocarpa.—*K. Macarthuri*, Hort.=Ptychosperma Macarthuri, which see.—*K. Mooreàna*, F. Muell.=Clinostigma Mooreanum.—*K. Mòrei*, Hort. Dreer. Possibly same as K. Mooreana.—*K. rubricaùlis*, Hort. Lvs. pinnate, ovate, with red petioles. Adv. 1895.—*K. rupícola*, Hort. Adv. 1895.—*K. Sanderiàna*, Hort. Very slender in habit, very hard foliage, spreading: lfts. very narrow, arranged on an arching rachis similar to Cocos Weddelliana. A graceful plant for jardinieres or conservatories. A.G. 20:223. A.F. 20:603. Gn.M. 2:226. G. W. 2:399.—*K. sápida*, Mart.=Rhopalostylis sapida.—*K. Van Houttei*, Hort.=Veitchia, sp. (?). Adv. 1895.—*K. Vèitchii*, Hort. probably = Hedyscepe Canterburyana.—*K. Wendlandiàna*, F. Muell.=Hydriastele Wendlandiana.

N. TAYLOR.†

KENTIÓPSIS (Greek: *like Kentia*). *Palmàceæ*. A small but very handsome group of palms with tall unarmed stems.

Leaves equally pinnate; pinnæ sub-opposite, very coriaceous, narrow, sword-shaped, narrowed to the obtuse or toothed apex, with strong mid-nerve, prominent veins and thickened margins: spadix large, thick, the branches stout and long; fls. monœcious, spirally disposed; ovary globose-ovoid followed by a thick-walled fr.—There are 3 species, all Australian. G.C. II. 25:75. Kentiopsis belongs to a large group of genera mentioned under Hedyscepe, which differ from Kentia in having the ovule fastened on the side of the locule, and more or less pendulous, instead of fastened at the base and erect, as in Kentia. Kentiopsis is distinguished from Hydriastele by having its fls. arranged spirally instead of in 4 ranks. From numerous other cult. allies it is distinguished by the following characters: stamens numerous, 20–25: lf.-segms. narrowed, obtuse or dentate: sepals of the staminate fls. triangular-orbicular, broadly overlapping. Cult. as in Kentia.

macrocárpa, Brongn. (*Kéntia Lindenii*, Hort., Lind. *Kéntia Lucìani*, Lind.). About 20 ft., usually less in cult.: rachis flat above, convex below. The form known as *Kéntia Lucìani*, has bright green lvs., tinged with brown on the under surface, the young petiole yellowish, later becoming brown. I.H. 24:276; 29:451. R.H. 1881:372. F. 1884, p. 71. S.H. 2:117.—The species is distinguished by the reddish tinge of the young lvs.

K. divaricàta, Brongn. (Kentia divaricata, Planch.), is referred by Drude in Engler & Prantl, to Drymophlœus. It may be distinguished from the preceding by the alternate pinnæ and triangular rachis, keeled above. I.H. 28:409. This has been confused in the trade with Kentia gracilis, which is referred by Index Kewensis to Microkentia gracilis. See I.H. 23:245. Advertised 1895.—*K. oliviæfórmis*, Brongn., is characterised by the 4-angled rachis. Not cult.

N. TAYLOR.†

KENTUCKY BLUE GRASS: *Poa pratensis.*

KENTUCKY COFFEE TREE: *Gymnocladus canadensis.*

KERNÈRA (Johann Simon von Kerner, 1755–1830, professor of botany at Stuttgart). *Cruciferæ*. Under this name amateurs cult. a rock-plant growing about 4 in. high, which blooms profusely all summer, its fls. being small, white, and borne in elongated umbels. Bentham & Hooker regard Kernera as a subgenus of Cochlearia, in which the stamens are longer and bowed at the apex: pods turgid; valves very convex: cotyledons accumbent or incumbent. Prantl (in Engler & Prantl, Pflanzenfamilien), however, keeps the genus distinct, comprising 5 species in the mountains of Cent. and S. Eu. They are perennial herbs, with simple or pinnately parted lvs.

The species grown in rock-gardens is a compact branching, neat-habited plant thriving in any light soil that is moderately rich. It requires a sunny but not too dry situation. Prop. by cuttings, division or seed. *K. saxátilis*, Reichb. (*Cochleària saxátilis*, Linn.). Root-lvs. oblong, dentate, pilose; st.-lvs. linear-oblong: petals 4, obovate, 2–3 times as long as the calyx: seeds numerous, not margined. Pyrenees to Carpathians.

WILHELM MILLER.

KÉRRIA (after William Kerr, a gardener who introduced this and many other plants from China; d. 1814; not J. Bellenden Ker or M. Kerr, as often stated). *Rosàceæ*. A monotypic genus, one of the first shrubs brought from Japan, best known by its weak, slender green branches, slender irregularly toothed leaves and large yellow flowers.

From Rhodotypus, a close relative, it differs in its 5 rather than 4 petals, 5–8 rather than 4 carpels, and in the dry achene rather than drupe. The related genus Neviusa lacks petals, and has 2–4 carpels. **K. japónica**, DC. (*Córchorus japónicus*, Thunb.), is a very common bush in yards under the name of JAPANESE ROSE, CORCHORUS and the prevailing double form as GLOBE-FLOWER. (Fig. 2033): lvs. simple, alternate, ovate-lanceolate, acuminate, largely unequally serrate, 1–2 in. long, clear green above, pale below, thin, slightly pubescent: fls. abundant, solitary, terminal, peduncled, 1–2 in. diam. appearing in June and more or less throughout the year; calyx persistent, 5-lobed; petals 5, large, yellow, ovate; stamens numerous: carpels 5–8, globose, distinct. A.G. 18:425. F.E. 9:593. R.H. 1869, p. 293. Gn. 21, p. 275. Var. **flore-plèno**, double, more vigorous and more frequent in cult. than the single. B.M. 1296. G. 26:345; 27:146. G.M. 50:210. G.Z. 9:48. Var. **grandiflòra**, a vigorous form with large fls. Var.

vittato-ramòsa, Zabel (*K. ramùlis variegàtis aùreis*), a dwarf form, the branches striped with yellow and green. Var. **argénteo-variegàta,** 2–3 ft. high, with small green lvs. edged with white.

Kerria japonica grows 4 to 8 feet high and as broad as high, with numerous short-branched, spreading stems, attractive in winter from its light green branches; in early June, when its blossoms appear in greatest abundance; in November, when the leaves are of a clear yellow; and is not unattractive throughout the whole year. It is a refined plant and deserves free use in ornamental planting, either in simple masses or at the front of a shrubby group or border. It is not thoroughly

2033. Kerria japonica, the single-flowered form. (×½)

hardy in all situations in the northern states, the tips of its branches often winter-killing, which causes it to demand a well-drained and partially sheltered position. It grows in any good garden soil. Although enduring sunlight, it is best in partial shade, since the intensity of full sunlight partially bleaches the flowers. It is propagated by cuttings, layers and root-divisions.

A. PHELPS WYMAN.

KERSTINGIÉLLA (Dr. Kersting, of Togoland). *Leguminòsæ.* A very recently described African plant that produces a bean underground, much after the manner of peanut. It is widely cult. by the natives of Trop. Afr. for food, *K. geocárpa,* Harms (*Voandzèia Poissonii,* Chev.). It is a prostrate herb, the main st. creeping, 2–3 in. long, and rooting at the nodes: lvs. 3-foliolate, rising on slender petioles, the lfts. broadly ovate or obovate, obtuse: fls. small, in pairs or solitary, subsessile in the axils (on the ground); corolla papilionaceous, greenish white but the standard pale violet at tip: pod maturing underground, indehiscent, usually divided by 1 or 2 constrictions into 2 or 3 joints; seeds oblong or oblong-ovoid, about ¼in. long, white, red or mottled: "after fertilization, the solid base or stipe of the pistil, which in the fl. is very short, lengthens into a carpopodium and at the same time turns toward the ground; then the corolla and the style are thrown off. The ovary, still very small, is pushed out of the calyx, and by the root-like carpopodium gradually driven into the ground, where finally the growth and the maturation of the ovary into the seed-bearing pod take place."—Kew Bull., 1912, p. 209, with fig. See *Voandzeia.*

L. H. B.

KETELEÈRIA (after Jean Baptiste Keteleer, a French nurseryman, born in Belgium). *Pinàceæ.* Ornamental trees, grown for their handsome fir-like foliage and distinct habit.

Evergreen, of regular pyramidal habit while young, in old age with a broad flat-topped head: winter-buds globose or ovoid, not resinous: lvs. linear, flat or keeled, not grooved above, pale green below, appearing 2-ranked: staminate fls. arranged in clusters: cones upright, with persistent woody scales; bracts inclosed, about half as long as the scales; wings of seeds as long as the scales.—Three or possibly only 2 species in China. Closely allied to Pseudotsuga and chiefly distinguished by the clustered staminate fls. and the upright fir-like cones. In foliage most similar to Abies but easily distinguished by the flat lvs. being keeled, not grooved above and pale green, not marked with white or whitish lines beneath.

The keteleerias are little known in this country and are not hardy North, though the recently introduced *K. Davidiana* is probably hardier than the better known *K. Fortunei.* They are handsome trees, of fir-like habit while young, but old trees become flat-topped with wide-spreading branches resembling somewhat the cedar of Lebanon in habit. Propagation is by seeds and by cuttings.

Fórtunei, Carr. (*Àbies Fórtunei,* Murr. *Pseudotsùga jezoénsis,* Bertrand. *Pìnus Fórtunei,* Parl. *Abiètia Fórtunei,* Kent). Tall tree, to 100 ft.: branchlets glabrous, orange-red: lvs. twisted so as to form 1 plane, linear, rigid, mucronate or spiny-pointed, flat, with the midrib prominent on both sides, glossy dark green above, paler below, 1–1¼ in. long: cones ovoid or cylindric-ovoid, 3–7 in. long; scales suborbicular, purple while young, later reddish brown. S. E. China. R.H. 1866:449; 1887, pp. 208–211; 1900, p. 202; 1904, p. 130. G.C. II. 21:348, 349. F.S. 7, p. 223; 9:858. J.F. 4, p. 29. G.W. 3, p. 125.

Davidiàna, Beissn. (*Àbies Davidiàna,* Franch. *Pseudotsùga Davidiàna,* Bertrand. *Àbies sàcra,* David). Tall tree, to 120 ft.: young branchlets puberulous: lvs. twisted into 1 plane, linear, rounded or notched at the apex, midrib raised on both sides, glossy green above, paler below, 1–1½ in. long: cones cylindric-oblong, 6–8 in. long, with orbicular-ovate scales, erose at the margin and recurved at the apex. W. China. R.H. 1873, pp. 37, 38; 1904, p. 131. G.C. III. 33:85. M.D.G. 1912:9 (habit of an old tree).

K. Evelyniàna, Mast. Closely allied to K. Davidiana and probably only variety of it. Lvs. 1½–2 in. long, obtuse or acutish: cones 2–3 in. long, with oblong-ovate scales. S. W. China. G.C. III. 33: 194.—*K. Fàbri,* Mast.=Abies Delavayi, Franch., a recently intro. Chinese species.

ALFRED REHDER.

KIDNEY BEAN. Common name in England for the garden beans in distinction from the lima bean, the former being *Phaseolus vulgaris,* the latter *P. lunatus.*

KIDNEY VETCH; *Anthyllis.*

KIGÈLIA (from a native name). *Bignoniàceæ.* About a dozen trees of Trop. Afr. (cne extending into S. Afr.), remarkable for the long-hanging fls. and frs. Lvs. odd-pinnate: fls. orange or red, on long-peduncled lax panicles; calyx 2–5-lobed, campanulate; corolla broadly campanulate and narrowing below into a straight cylindrical or constricted tube, the limb 2-lipped; upper lip 2-lobed and nearly erect; lower lip deeply 3-lobed and deflexed; stamens 4, didynamous,

somewhat or partially exserted; disk ring-like: fr. a cylindrical, indehiscent rough body, with a thick exterior and a fibrous pulp holding the seeds. **K. pinnàta,** DC. (Fig. 2034), the "fetish-tree" and "sausage-tree," is offered in S. Calif., and specimens may be expected in botanical collections in the W. Indies. It is native of the Mozambique district in Afr., where it makes a tree 20–50 ft. high, according to Sprague: lvs. ternate, the lfts. 7–9, elliptic-oblong or obovate and 3–6 in. long, serrate or entire, usually glabrous above but sometimes more or less pubescent beneath, the lateral lfts. sessile but the terminal one with a stalk several inches or a foot long: fls. claret-colored, with a corolla-tube to 3 in. long dilated at the mouth, and lobes to 2½ in. long: fr. 12–18 in. long, blunt, 5 in. diam., hanging on a peduncle or cord often several ft. long, making very striking objects. In parts of Afr. this tree, or possibly a related species, is said to be held sacred; and the fr., when cut and slightly roasted, is said to be used as outward applications in certain diseases. The tree is practically unknown in the U. S. G.C. III. 50, suppl. Aug. 12 (1911). L. H. B.

KIN-KAN: *Kumquat.*

KINNIKINNICK: Dry bark of *Cornus Amomum,* smoked by western Indians.

KINO. A dark red or blackish plant product, usually of a resinous nature, rich in tannin. There are numerous kinds of kino obtained from plants of different families; some are used in medicine as an astringent, others are employed in dyeing and tanning. The Australian or Botany Bay kino is derived from various species of Eucalyptus. *E. resinifera* is known as the kino eucalypt.

KIRENGESHÒMA (Japanese words meaning *yellow Anemonopsis macrophylla*). *Saxifragàceæ.* One perennial yellow-flowered herb from Japan, *K. palmàta,* Yatabe, which has lately received attention in England where it has proved hardy and appears to be adapted to the shady border or rock-garden; prop. by division. The plant grows at an elevation of over 5,000 ft. in Japan, on Mt. Ishizuchi. Two to 4 ft., upright, the sts. slender and glabrous: lvs. large and papery, all the lower ones petioled, round-cordate and palmately 7–10-lobed, hairy on both surfaces, the lobes acute and coarsely toothed: fls. overtopping the lvs., on usually 3-fld. peduncles, nodding; corolla bell-shaped, to 1¾ in. long, the 5 petals oblong-lanceolate and recurved above the middle: fr. a loculicidally dehiscing caps. B.M. 7944. Gn. 64, p. 246; 74, p. 573. G. 27:421. R.H. 1908, p. 153. L. H. B.

KITAIBÈLIA (Paul Kitaibel, 1757–1817, of the botanic gardens at Pesth). *Malvàceæ.* One garden species from the S. Danube region, planted in the open, **K. vitifòlia,** Willd. Hardy robust perennial herb, to 8 ft., allied to Malope: lvs. angled or 5-lobed, toothed: fls. white or rose, showy, sometimes many and sometimes solitary in the axils; involucre surpassing the calyx, the bracts connate at base and 6–9-parted; calyx 5-parted; petals 5, obovate, narrowed almost to a claw; staminal column divided at apex into many filaments; ovary many-celled, the carpels becoming congested into a head, dehiscent. It is a plant somewhat on the order of abutilon, with vine-like or maple-like lvs. It thrives in any usual garden soil, and is said to be good for naturalizing in the shrub plantations and elsewhere; prop. by division or by seeds. B.M. 821.

K. Balánsæ, Boiss., is a second species very like K. vitifolia, but the lvs. deeply 5-lobed, stipules ovate, the bracts of involucre much exceeding calyx and oblong-lanceolate and cohering or grown together at base. Cilicia.—*K. Lindemuthii,* Hort., is a graft-hybrid, produced by grafting K. vitifolia on Abutilon Thompsonii. Lvs. variegated or marbled as in the abutilon stock: plant 6–8 ft. Named for H. Lindemuth, of Berlin, its raiser. L. H. B.

KITCHEN-GARDEN and FLOWER-GARDEN. The kitchen-garden is for the kitchen,—to grow the supplies that are used in cookery and on the table as food. We ordinarily think of it only as a vegetable-garden, yet it may grow strawberries and other small fruits; and in England the melons are classed with fruits even if grown in the kitchen-garden. It is in the kitchen-garden, also, that the sweet herbs and the garnishing plants may be grown; and flowers need be no strangers to it. In fact, some of the best and most attractive kitchen-gardens may be comprised of vegetables, fruit bushes and flowers,—all grown for the table and the home.

2034. Kigelia pinnata.

The essential idea is the home-gardening idea; and therefore it is difficult to separate the home vegetable-garden and the home flower-garden by any hard-and-fast or arbitrary line.

If the place is large enough to have been laid out in a landscape treatment, the home-garden area has been set aside in its place, proper both for exposure and convenience. With this landscape plan we have nothing to do at the moment except to insist that the home-garden idea shall not have been overlooked and that it shall form one essential part in an artistic subdivision of the property.

The kitchen-garden of vegetables.

Human diet consists chiefly of three classes of foods: first, meats, high in protein, useful for structural purposes; second, cereals and other starchy or carbohydrate foods, useful for their high fuel-value; and third, vegetables and fruits. The last mentioned contain but little material for building body or for supplying energy; but they offer other substances seemingly less important, but which are absolutely essential. Most notable among these are the mineral elements. The flavoring and appetizing qualities are scarcely less important, and the requirement for comparatively bulky foods is no more to be neglected in human than in animal nutrition. The truth of these assertions is evident in the fact that no meal is regarded as complete without its vegetarian dishes, and more especially is it emphasized in the intense craving for this sort of food which is experienced in the spring months by those who enjoy but little of it during the winter. Indeed, one can hardly avoid tracing a connection between the meat and cereal diet of the old-time winter and the once accepted notion that one must necessarily be in poor physical condition as spring approaches, and resort to the use of "spring bitters." In fact, certain definite disorders are clearly traced to the lack of vegetable food.

More appealing than the nutritional value of the vegetable food is its value as a contribution to good living. No diner is satisfied unless vegetables appear on the menu, and the products of the garden add widest variety in the form of condiment and salad, as well as

in the main part of the meal. Paragraph after paragraph might be written in praise of the endless array of delicacies which are offered by the skilful housewife who is in league with the skilful gardener.

Vegetable food is procured in two ways,—by purchase and by culture. The former method is not available to many who dwell in the open country. To the townsmen it is open to very serious objection. The cost is usually high, often exorbitant and prohibitive. The varieties are more often selected for resistance to the rigors of shipment and sale than for excellence of table quality. For example, the leading commercial sort of celery is far surpassed by others, and the most widely grown winter cabbage—the best keeper of all—lacks tenderness and flavor. The market watermelon of long experience in freight cars sadly lacks in quality. Even though a product be good when it leaves the farm, the delays in handling to which it is subjected rob it of its freshness and its delicacy of flavor. Lettuce cannot be made to retain its garden crispness, and the sweetness of sugar corn speedily departs. Moreover, market-bought vegetables are often in thoroughly unclean condition.

The second source of supply is the kitchen-garden. By this means are the shortcomings of the urban vegetable supply avoided by many townsmen, and a notable contribution to the farm income is afforded. An experiment continued for five years at the Illinois Experiment Station showed an average return of $105 from a half-acre garden. The average cost was $30. Under intensive culture on small areas, each square foot of ground may be brought to yield, for example, lettuce to the value of 10 or 12 cents, followed by tomatoes worth 6 to 12 cents. These figures are offered merely to suggest possibilities and not to form a basis for calculating the value of back-yard gold mines. Perhaps the gold mine is there, but many factors must be considered in figuring its profits. It is safe to say that in the hands of a skilful gardener a city back yard may mean as much to the family budget as a 5 per cent increase in an ordinary "middle class" salary, and a suburban garden offers far greater possibilities. In the door-yards and vacant lots of our cities lie locked up one of the great economic resources of the state. The value of products of the kitchen-gardens in New York alone already runs into the millions of dollars and should be many times doubled. So much for the material gain. No less to be prized are the dividends which are paid in the joys of a variously laden table and in the satisfaction and pleasure of production. The city dweller can find no better means of recreation and exercise. A garden is an ideal hobby.

It is impossible to tell in detail how to make a garden. It is possible only to offer certain generalities and suggestions which may be helpful to one who is learning how to cope with a given set of conditions. Circumstances vary so widely that almost any statement may be wrong in some cases, and rule-making is always unsafe. Experience is the best teacher, and one who loves plants and the soil and who is willing to see and to think and to do the best that one knows may be confident of increasing success from year to year.

Location.

It often happens that no choice is offered as to the location of the vegetable-garden, but when this is not the case, an outline of desirable points may be of service. While one whose domain is measured in feet and inches rather than in rods is forced to utilize the plot which is at hand, the garden factor should certainly be considered in choosing a place for a home.

On the farm the garden should be near the buildings, for convenience in working. The distant garden is almost invariably neglected, while the nearby plot offers useful employment for odds and ends of the time of farm-hands which might otherwise be wasted. For example, the cultivation of a corn-field is finished an hour before noon. It is too late to go to a distant field, and the horse is turned into the home half-acre not to browse but to loosen the crusted soil. The garden should be near the home for convenience in gathering the products. If possible, a liberal water-supply should be available.

A gentle slope is desirable to insure good drainage. Exposure to the southeast affords the maximum advantage from the sun's rays and consequent maximum earliness of maturity. Protection from severe winds may be gained by placing the garden near farm buildings, wood-lot or hill. At the same time, the roots of trees, greedy for moisture, should be avoided.

Three points are to be borne in mind in the choice of soil. The most important is its physical character, for this is least readily modified. Heavy clay soils are plastic, sticky, and unworkable when wet and are lumpy when dry. They are retentive though not readily receptive of moisture and of plant-food. They are cold and late in the spring. Very light sandy soils are loose and friable and are workable even when wet. They are readily receptive though not retentive of water and nutrients, and are warm and early. The ideal is a well-drained sandy loam of moderate fineness.

The second point is that plant-food should be abundant and available. Dark, loose, friable soils are usually, though not always, as in the prairie states, of relatively high fertility, while light-colored soils usually lack humus and will require heavy additions of various amendments.

Thirdly, soil that is free of weed-seeds and of disease is to be preferred, and land that has been well cultivated is more likely to offer favorable bacterial relations.

Soil management.

A good garden cannot be expected on badly drained soil. Artificial drainage is often of great advantage even on soils that are not swampy. It makes for better physical character and earlier crops. If no outlet is available, a pit filled with stone or old brick may be used.

City lots frequently offer soils that are very unfavorable for gardening operations. It is seldom that the case is hopeless, even though excavated material, brick-bats and tin-cans abound. In some cases it is profitable to haul in good soil bodily, although this material is expensive. Coarse soil should be removed, and improvement brought about, if the soil is heavy, by the use of such materials as ashes, sand, other soil, manure, and lime. A stiff clay which is being broken in for garden purposes should be spaded or plowed in the fall and left in clods, in order that the frost of winter may have its full effect in rendering it workable. A sterile sand may be rendered productive by the liberal use of manure and by applications of lime.

In any garden, the main reliance for maintenance of soil fertility should be on stable manure. In this material are added nitrogen, phosphorus, and potash, the only chemical elements which are often lacking, together with large quantities of humus. Manure that has rotted for some months is better than new manure, especially if it is to be worked into the soil in the spring. However, a heavy coat of fresh material may be plowed under or spaded under each fall. It will be fairly well decayed and ready to aid the plants by spring.

In Europe, the process of trenching is frequently practised in intensive gardening. The plot is divided lengthwise, and a trench 2 or 3 feet wide and 1 to 2½ feet deep is dug across the end of one of these parts, throwing the soil outside the area to be trenched. In the bottom of this ditch is placed a heavy layer of fresh manure. The soil from the next adjoining block in the same division is turned over upon this, and a

layer of manure placed in the bottom of the new ditch. Thus the work progresses to the other end of the division. Here the soil from the adjacent block of the second division is thrown into the last ditch of the first division, and then the work proceeds as before to the starting-point. The last trench is filled with the soil from the first. One or two years later the process is repeated. The layer of manure at the bottom is now well rotted and is thoroughly incorporated with the soil as the work progresses. The soil may be gradually deepened from year to year. This is a very desirable method of soil preparation, when the necessary hand labor is available.

Lime at the rate of perhaps a ton to the acre should be added every two to four years. It is useful in making clay soils more friable and in binding together very sandy soils, in correcting acidity, in freeing plant-food, and in rendering conditions unfavorable for certain diseases, although it is favorable to others. It makes little difference which form of lime is used, although quicklime is not conveniently handled. Either ground limestone rock or hydrated lime may be applied. About one-third more of the latter must be used than of the former.

The term tillage is often applied to the working of land previous to the planting of crops, and the working of soil after planting is spoken of as cultivation, although tillage properly includes all these operations. Tillage, as used to denote preparation of the land, improves the physical condition of the soil, rendering it more granular; it is useful for the improvement of the moisture relation as regards reception, retention, and transmission of moisture, it makes aëration possible, it assists in the incorporation and freeing of plant-food and in the destruction of weeds. If a soil is shallow, it should not be worked too deeply at first, but each year a bit of the subsoil may be incorporated in the surface soil, thus gradually deepening the root pasturage. The utmost care is necessary to avoid handling soils, especially the heavier sorts, when they are wet. The clayey types may be spaded or plowed with good results only at a certain stage of dryness. Experience only can teach this stage for a given soil. The work should be performed when the lumps crumble readily, as they are turned over. They should be neither plastic nor hard-baked.

When the ground is plowed or spaded in autumn, it should, as suggested above, be left rough over winter. In the spring it may be gone over with the disc-harrow or with the hoe. If plowed in the spring, the lumps should be worked down with plank drag, harrow, or rake, according to the circumstances, and a loose soil-mulch should be maintained until planting-time. If this is neglected, moisture may be lost so rapidly as to waste the equivalent of a half inch of rain a week. In very small areas, where these horse tools cannot be used, the hand implements that accomplish the same results on the soil may be employed.

For very early plantings it is well to prepare a few raised beds or ridges in autumn. These should have a southern or southeastern exposure. They will thaw out, drain and become warm much earlier in the spring than soil at the ordinary level, although they will dry out more rapidly in midsummer.

Planning.

The first task in each year's garden operations is the preparation of a good plan. This first phase of the garden work is often neglected. It should receive careful attention long before the season opens, in order that space and effort may be economized and that seed, fertilizer and other supplies may be provided. The materials for the work consist of a few good garden books and bulletins, a few catalogues of reliable seedsmen, together with paper, pencil, and ruler. A fund of experience in home-gardening is an asset of incalculable value. The aim should be to produce an abundance of vegetables of high quality, in wide variety, and as evenly distributed as possible throughout the year with a minimum of unprofitable labor and expense.

The first step is to decide what is wanted. Make a list of crops, bearing in mind the likes and dislikes of the family, even distribution through the season, adaptation to climate and soil, and the space available. List too few rather than too many, especially if the garden is small.

Avoid an over-large garden. An area 40 by 50 feet, well kept, will give greater satisfaction than a half acre neglected through press of other work. A half acre will yield a full summer and autumn supply for a large family, together with ample quantities for canning and storage. The beginner should avoid allowing his enthusiasm to lead him into deeper water than that in which he can swim. Better begin simply and let experience teach the best lines of development than to suffer failure and discouragement on account of an over-complex plan.

No area is too small to be utilized. A plot 2 feet wide and 12 feet long will yield, if well tended, as many as twenty bunches of radishes, thirty heads of early lettuce, and forty to sixty pounds of tomatoes. A fall crop of lettuce and radishes may even be matured in addition.

The larger garden should be longer than wide, in order to make the care easier. A ratio of two to one is frequently used. The rows of most crops should be far enough apart for horse cultivation. In a garden of limited area, where small amounts of many vegetables are sought, crosswise rows may be desirable. In such plots rows may be closer together, dependence being placed upon the wheel-hoe and hand-hoe for cultivation. Permanent crops, as asparagus and rhubarb, should be placed at one side to avoid interference with tillage. The hotbeds and coldframes should be in this same part of the garden. Early crops should be kept together, in order that a considerable area may be cleared up at once for later plantings. The same plants should not appear in the same part of the garden year after year. Good taste will suggest a neat arrangement, and some attention should be paid to symmetry and balance of appearance.

Three good garden plans are shown herewith, in Figs. 2035, 2036, 2037. They are by Albert E. Wilkinson, Cornell Reading-Course Bulletins. They are intensive plans,—made to utilize the land to the utmost and assuming good care, liberal fertilizing, and other close attention. With larger areas and horse labor, the distances may be greater.

The seed.

With the general plan completed, the next step is the choice of varieties and the preparation of the seed order. Only experience will offer a satisfactory knowledge of the sorts to be planted under a particular set of conditions. In the meantime, it is well to consult neighboring gardeners on this as well as on many other matters. Seed orders should be placed early to avoid disappointment as to varieties and to allow time for testing. The well-known seed firms are striving to supply good seeds, clean, viable, and true to type. Packet seeds found in grocery stores are sometimes uncertain. Many local seed-houses are thoroughly reliable.

The only true test for seed is to grow a crop from it. However, seed that will not establish in the soil a strong, healthy plant will certainly not grow a crop. It is accordingly well to test seed before it is planted. For this purpose, twenty-five, fifty, or one hundred seeds should be counted out and planted in a little box of garden soil in the house. This should be kept moist and at ordinary room temperature. Other methods of

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testing, by means of blotters, layers of cloth, porous dishes, and the like, afford knowledge only of the ability of the seed to sprout, not of its ability to complete the process of germination, that is, to establish itself in the soil so that it may make progress independently of the supply of food material that was stored within the seed coats.

No phase of gardening affords a more fascinating hobby than the selection and saving of seed from one's own plants. Some individuals are always superior to others, and this superiority is inherited to a greater or less degree. In the course of a series of years, remarkable progress may be made in increasing the returns from a given area. The first necessity is to establish in the mind a clear notion of the ideals to be secured. This must be very carefully worked out, for if it is necessary to modify it from year to year no progress will be made. Selections should be made on the basis of individual plants rather than of individual fruits. Every home-garden should be to some degree a plant-breeder.

Planting.

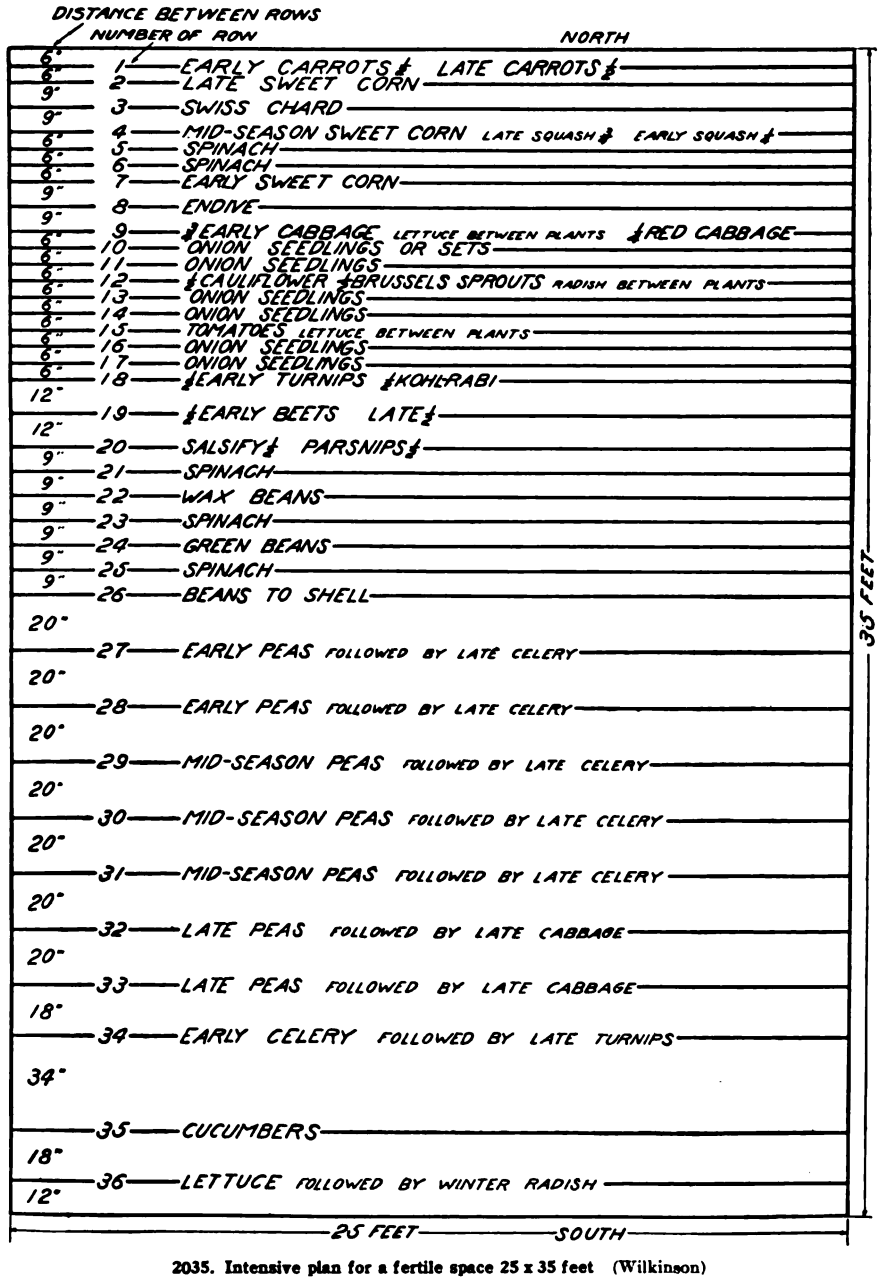
Each vegetable has its own peculiarities as to time and manner of planting. These characteristics are considered under each of the various crops.

The essentials for germination are moisture, warmth, and aëration. Light is not necessary, although, of course, it is required immediately after seedlings break ground. No general rules may be laid down for the sowing of seed. It is necessary that the soil be in good physical condition if the best results are to be attained, especially for the smaller and more delicate seeds. Seed must be sown more thickly in the case of the smaller and more delicate seeds, as celery and lettuce, in case the percentage of germination is not high, when the planting is made in very early spring, when soil conditions are unfavorable, as in a heavy soil or in time of drought, and in case serious devastation by insects or diseases is feared.

Commercial men try to know their soil and their seed and to sow just right. Until one has gained considerable experience, it is better in the home-garden to sow rather thickly, and thin after the plants have come up. Extreme thickness of sowing results in weak seedlings and a very large amount of tedious work to be done afterward.

Rules as to depth of sowing may have slight virtue, but they may also be rather seriously misleading. Seed should be sown more deeply in dry or sandy soils than in wet or heavy soils. Soaking seed before sowing is not ordinarily of very great value, although it is practised by some gardeners.

Seeds do not germinate until moisture has been imparted to them by the soil. The movement of moisture from soil to seed is a capillary movement and is more complete when there is very close contact between soil and seed. Accordingly, the soil should be carefully firmed in covering. This can hardly be overdone in

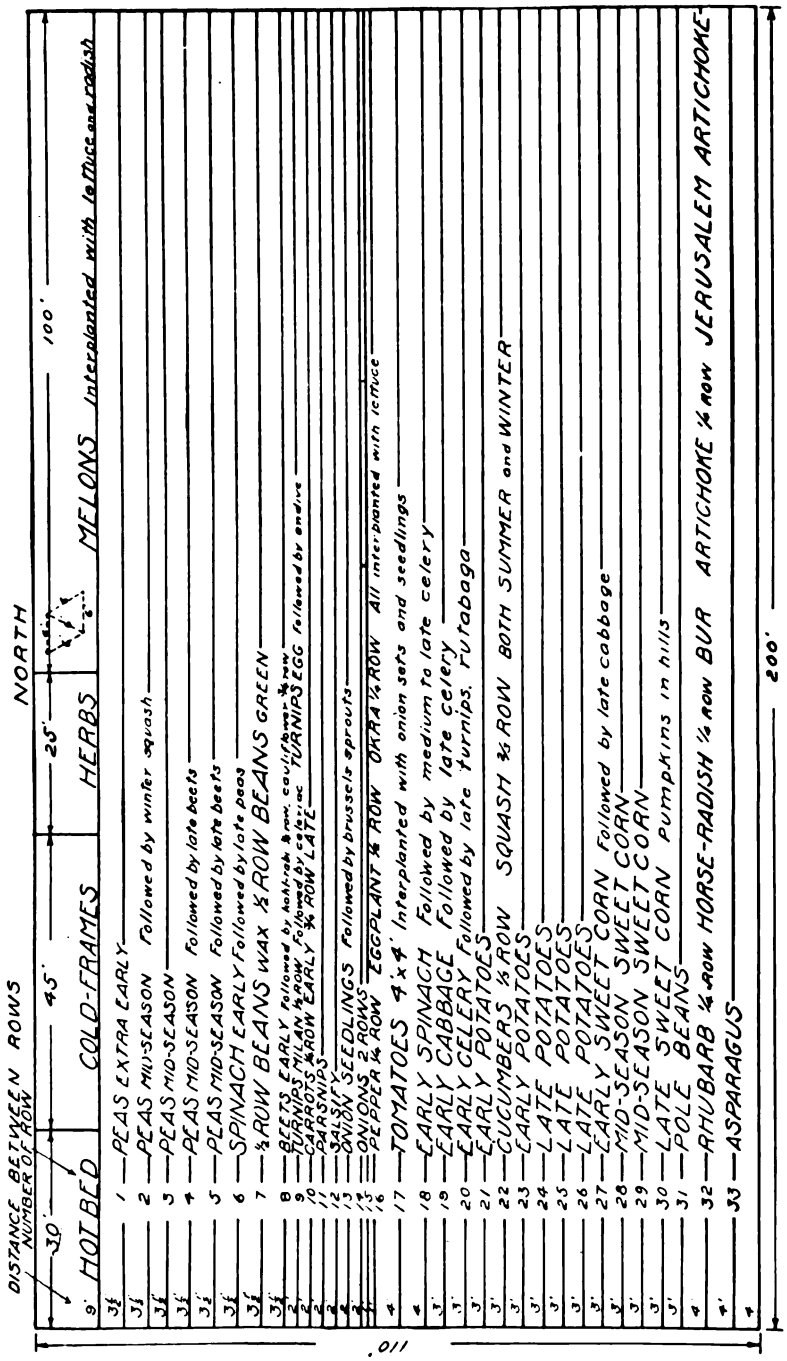


2035. Intensive plan for a fertile space 25 x 35 feet (Wilkinson)

sandy soils or in those that are rather dry. Clay soils should not be packed so hard. Sowing in drills is usually regarded as better than broad-casting, because it is easier to sow the seed at uniform depth, the seedlings are of mutual assistance to one another in breaking ground, it is easier to thin and to do other work, and the plants can be more easily cultivated.

In the small garden most sowing is by hand. Many methods are practised. When the fingers are used, the seed should be worked out by means of the thumb over the second joint of the first finger. Many gardeners like to use an envelope which has been sealed at the side and cut off squarely at the end. A small quantity of seed is placed in this envelope, which is held the flat way, the opening only very slightly spread. It is held with the opening parallel to the rows and is shaken with a motion in the same direction.

Mechanical drills are now widely used and are almost indispensable in the larger gardens, the chief advantages being uniformity of work and rapidity of action. A seed-drill is not a cure-all for planting troubles. It requires as much skill as any other method. Since there is such great variation in the size of seed of a given kind, the scales on the machines can be used only as a general guide, and the machine should be tried on the bare road or on a floor before beginning work.



2036. Close-planting plan for a space 110 x 200 feet. (Wilkinson)

Growing early plants.

One of the most dearly cherished ambitions of the amateur gardener is to begin the harvest of his products very early in the season. To accomplish this, it is necessary to sow seed long before outdoor planting is possible. Plants for setting outdoors should possess such vigor and hardiness that they will make steady growth in spite of possible unfavorable conditions which they may encounter. Other advantages of starting plants in the seed-bed, either indoors or outdoors, are fuller utilization of space in the garden, greater ease in caring for both the soil of the garden and the plants themselves, better root-systems, and in some cases even greater yield. The specific methods of plant-growing are considered under the various vegetables in this Cyclopedia.

There are three ways in which this work for earliness may be managed. Seed may be sown for outdoor transplanting in small plant-boxes in the house. If plenty of window room is available and temperature within the house is under fair control, seed may be started very early and the seedlings transplanted once before they go to the garden. Another possibility is sowing seed indoors, transplanting the seedlings to the coldframe, where they are under protection for some weeks, and then placing in the garden. The next step would be the use of hotbeds and greenhouses (see *Hotbed*). The gradation in construction from hotbed

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to greenhouse is very simple, some houses being constructed with two rows of hotbed sash for a roof and using manure for heat. Other types may be built in all degrees of complexity. Fig. 2037 (p. 1747) shows how completely a hotbed space may be utilized.

In plant-growing, relatively low temperatures, free ventilation, sparse watering and abundant sunshine make for stockiness, hardiness, good root-systems, vigor and freedom from disease. Plants should be carefully hardened before they are placed outdoors by increasing the ventilation, lowering the temperature, and keeping them relatively dry.

Transplanting.

Soil should be in excellent physical condition if plants are to be set in it. A good degree of moisture should be present, and if possible, the work should be performed in cloudy weather or in the evening, in order that the plants may have opportunity to recover before being exposed to strong sunshine. It is not wise to undertake setting warm-blooded plants like the tomato exceedingly early, as they may be severely stunted by cold weather, even though there be no frost. Some gardeners, however, like to set out a few plants very early, expecting to replace them if necessary.

Most plants ought to be moved with a good-sized ball of earth. If the soil is in proper state of moisture and is compacted firmly about this earth ball, the plants will hardly be disturbed. Plants should ordinarily be set just a little deeper than they stood in their previous place.

Cultivation.

By cultivation is here meant the maintenance of a loose mulch of dry soil on the entire surface of the garden throughout as much as possible of the growing season. The maintenance of this mulch is of great value in retaining moisture, in keeping the soil in good physical condition, and in destroying weeds. In the small gardens, the hand-hoe and hand-weeder will meet every requirement without undue labor. A man-power wheel-hoe is useful in medium-sized gardens, usually when the rows are 40 feet or more long. The farm garden should be cultivated as far as possible by means of the horse-cultivator. When wheel-hoe and horse-cultivator are used, it is necessary to go through afterward and loosen the earth and destroy the weeds in the rows themselves. There are many types of weeders, hoes, and cultivators. Selection must be made according to the character of the soil, of the crops, and the individual fancy of the gardener himself.

Mulching.

The general effects of cultivation may be attained, in the case of thoroughly well-prepared soils, by mulching. A coat of comparatively coarse manure is spread on the soil between rows of vegetables. This practice has proved very satisfactory with celery and tomatoes. It is especially desirable with the latter crop, because it keeps down the weeds and conserves the moisture after cultivation is no longer possible.

Watering.

Hardly a summer passes in which the garden does not suffer from lack of water, in some month or other, in spite of the utmost care in cultivation. Water may be applied to small gardens by means of hose or by allowing it to flow into the furrows between the rows. Hose irrigation is usually superficial. Gardeners often think that they have watered the garden when they have merely moistened the surface. It is better to water thoroughly and less frequently than to water lightly every day. Of recent years, overhead sprinkler systems of irrigation have been devised. Those that are equipped with whirling sprays are not thoroughly satisfactory because they do not water evenly. Another type consists of pipes supported over the garden in which are inserted tiny nozzles at distances of about 3 feet. With forty pounds pressure, these nozzles will throw water for about 25 feet. The pipe is supported in such a way that it may be turned to throw a spray far to the side or directly overhead. Thus a belt 50 feet wide will be covered by a single line. The question is raised as to whether this type of irrigation would be as successful in home gardens with their many crops as it is in large commercial plantings of single crops. There seems to be little definite knowledge at present on this point, but the plan would seem to be thoroughly feasible. Nature does not water one crop at a time. Practice in the handling of garden irrigation has not been studied as fully as it should be. See *Irrigation*, p. 1682.

In warm summer weather, it is usually best to water in the evening so that the foliage will be well dried off by morning. It is not likely that watering in midday in the summer does as much harm as is ordinarily supposed.

Other work.

The summer work of training, pruning, blanching, pest control, and the like, is considered under the different entries in the Cyclopedia and under *Diseases and Insects* in Vol. II.

The last task of autumn is one of the most important,—cleaning up the garden completely. Many of the diseases and insects are wintered over in the refuse that is left on the soil.

The garden-lover who is interested in making the greatest possible progress from year to year will keep careful record of his operations. He will preserve the plan that he has drawn up for each season's operations, and, while avoiding an elaborate or cumbersome scheme, he will jot frequent notes as to dates of frost and other weather conditions, dates of planting, transplanting, and maturity of crops, behavior of plants from seed from different sources, and countless other points that will occur to him. Such a record requires but little time and is of almost incalculable advantage in future operations.

Books and bulletins.

There are many good bulletins and books on vegetable-gardening, some of them specially adaptable to the needs of the home gardener. The reader should consult the list on page 1553. The following are useful for the beginner:

"Home Vegetable Gardening," by F. F. Rockwell.
"The Home Garden," by Eben E. Rexford.
"The Vegetable Garden," by Ida D. Bennett.
"How to Make a Vegetable Garden," by Edith Loring Fullerton.
"Book of Vegetables," by Allen French.
"Manual of Gardening," by L. H. Bailey.
"The Home Vegetable Garden," Farmers' Bulletin No. 255.
"Hotbeds and Coldframes," Cornell Reading-Course Bulletin No. 30.
"Home-Garden Planning," Cornell Reading-Course Bulletin No. 34.
"Planting the Home Vegetable Garden," Cornell Reading-Course Bulletin No. 58.
"Summer Work in the Home Garden," Cornell Reading-Course Bulletin No. 92; and others.
"The Home Vegetable Garden," Illinois Circular No. 154.
"The Farmer's Vegetable Garden," Illinois Bulletin No. 105.
"Farmers' Home Garden," West Virginia Bulletin No. 122.

Tables and lists.

The home-gardener will soon acquire sufficient experience to be independent of rules and lists; and yet even the oldest gardeners like to have such lists and tables at hand to refresh the memory. The beginner is likely to follow these tables and lists slavishly and without imagination; but if he uses them as suggestions to be modified and applied in his own work, he should find them much worth the while. The remainder of this article comprises tabular material from Albert E. Wilkinson, Cornell Reading-Course Bulletin No. 34. The suggestions are for the state of New York; the consultant should know how to apply them elsewhere.

PLANTING-PLAN FOR A VEGETABLE-GARDEN 25 x 35 FEET. (See Fig. 2035.)—Wilkinson

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed or plant (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Beans, green snap	24	1 pt.	$0.20	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	July 1–15	Sept. 1	
Beans, wax snap	22	1 pt.	.20	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	July 1–15	Sept. 1	
Beans, shell	26	1 pt.	.15	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	Aug. 1	Sept. 30	
Beets, early	½ of 19	1 pkg.	.05	April 15	Drills	½–¾	¼–½	June 15–30		Greens	June 15–30	Aug. 1	
Beets, late	½ of 19	1 pkg.	.05	May 15	Drills	½–¾	¼–½	July 1–15	4	Greens	July 15–30	Oct. 15	Winter
Brussels sprouts	½ of 12	1 pkg.	.10	Mar. 15	Hotbed	½	12	.....	.....	.....	Aug. 1	Oct. 1–15	
Cabbage, early	¾ of 9	1 pkg.	.10	Mar. 15	Hotbed	.....	18	.....	.....	.....	July 15–30	Sept. 1–15	
Cabbage, late	32, 33	1 pkg.	.05	May 15	Hotbed	.....	24	.....	.....	.....	Aug. 1–15	Nov. 1	Winter
Cabbage, red	¼ of 9	1 pkg.	.05	April 15	Hotbed	.....	24	.....	.....	.....	July 30	Oct. 30	
Carrots, half-long	½ of 1	1 pkg.	.05	April 15–30	Drills	½	¼–½	June 1–15	2	Destroy	July 1–15	Aug. 15	
Carrots, long	½ of 1	1 pkg.	.05	April 15–30	Drills	½	¼–½	June 1–15	3	Destroy	July 15–30	Oct. 1–30	Winter
Cauliflower	½ of 12	1 pkg.	.20	April 15	Hotbed	.....	18	.....	.....	.....	July 1–15	Oct. 15.	
Celery, early	34	1 pkg.	.10	Mar. 15	Hotbed	.....	4	.....	.....	.....	June 1–15	July 15	
Celery, late	27, 28, 29, 30, 31	1 pkg.	.10	May 1	Hotbed	.....	5	.....	.....	.....	Sept. 15	Nov. 15	Winter
Chard, Swiss	3	1 pkg.	.05	April 15	Drills	½–¾	¼–½	June 15	12	Greens	June 15–30	July 15	
Corn, early	7	½pt.	.10	May 15	Hills	1	3	July 1	Hills 18	Destroy	July 30	Sept. 1	
Corn, midseason	4	½pt.	.10	June 1	Hills	1	3	July 15	Hills 18	Destroy	Aug. 15	Sept. 15	
Corn, late	2	½pt.	.10	June 15	Hills	1	3	July 30	Hills 18	Destroy	Sept. 1–15	Sept. 30	
Cucumbers	35	1 pkg.	.05	May 15	Drills	½–¾	1	July 1–15	6	Destroy	Aug. 15–30	Sept. 15–30	
Endive	8	1 pkg.	.05	May 1	Drills	½	½	June 15	12	Greens	July 15	July 30	
Kohlrabi	½ of 18	1 pkg.	.05	Mar. 15	Hotbed	.....	6	.....	.....	.....	May 30	June 15–30	
Leek	16, 17	2 pkgs.	.10	April 1	Hotbed	.....	3	.....	.....	.....	June 1–15	July 1–15	
Lettuce	Part of 36	2 pkgs.	.20	April 1 on	Hotbed	¼–½	10	.....	.....	.....	May 20–30	All seasons	Plant wherever space allows
Onions	10, 11, 13, 14	3 pkgs.	.30	April 7	Hotbed	.....	3	.....	.....	.....	June 1–15	Aug. 15–30	Plant wherever space allows
Parsnips	½ of 20	1 pkg.	.05	April 15	Drills	¼–½	¼–½	June 1–15	4	Destroy	Sept. 1–15	Oct. 30	Winter
Peas, early	27, 28	1 qt.	.65	April 1–15	Drills	1½–2	Close	.....	.....	.....	June 15–20	July 1–10	
Peas, midseason	29, 30, 31	1½ qts.	1.00	April 15–30	Drills	1½–2	Close	.....	.....	.....	June 30	July 15–20	
Peas, late	32, 33	1 qt.	.45	May 1–15	Drills	1½–2	Close	.....	.....	.....	July 15	Aug. 1–10	
Radishes, early	Part of 12	2 pkgs.	.10	April 1 on	Drills	½	½	1 week after planting	1–1½	Destroy	May 1	All seasons	Plant wherever space allows
Radishes, winter	36	2 pkgs.	.10	June 1	Drills	½	½	June 15–20	6	Destroy	Sept. 1	Oct. 15–30	Winter
Salsify	½ of 20	1 pkg.	.10	April 15–30	Drills	½	½	June 1–15	4	Destroy	Sept. 1–15	Oct. 30	Winter
Spinach	5, 6, 21, 23, 25	¼lb.	.25	April 1–30	Drills	½	½	May 30	3	Greens	May 15–30	June 30	Plant wherever space allows
Squash, early	¼ of 4	1 pkg.	.05	May 1	Corn hills	¾	Corn hills	.....	.....	.....	June 15–30	July 15	
Squash, late	¾ of 4	1 pkg.	.10	May 15	Corn hills	¾	Corn hills	.....	.....	.....	Sept. 1–15	Oct. 15	Winter
Tomatoes	15	1 pkg.	.05	April 1	Hotbed	.....	36	.....	.....	.....	June 15–30	Sept. 15–30	
Turnips, early	½ of 18	1 pkg.	.05	April 1–15	Drills	½	½	May 15–30	6	Destroy	June 1–15	Aug. 1	
Turnips, late	34	2 pkgs.	.10	May 15	Drills	½	½	June 15–30	10	Destroy	Aug. 15	Oct. 1–15	Winter
			$5.60										

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PLANTING-PLAN FOR A VEGETABLE-GARDEN 110 x 200 FEET. (See Fig. 2036.)—Wilkinson

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Transplanting		Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed (inches)	Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Artichokes, bur..	¼ of 32	18 roots	$2.25	.....	.....	.....	.....	April 15	36	.....	.....	.....	Sept. 30	Oct. 30–Nov. 30	
Artichokes, Jerusalem.....	¼ of 32	48 roots or 1 qt.	.25	.....	.....	.....	.....	April 15	12	.....	.....	.....	Sept. 30	Nov. and next spring	
Asparagus.....	33	200 two-yr.roots	2.00	.....	.....	.....	.....	April 15	12	.....	.....	.....	Two years after planting	May to June 1 after three yrs.	On to July 4
Beans, green....	½ of 7	1 qt.	.35	May 1–15	Drills	1	1 to 2	.....	.....	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
Beans, wax.....	½ of 7	1 qt.	.40	May 1–15	Drills	1	1 to 2	.....	.....	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
Beans, pole.....	31	1 qt.	.35	May 1–15	Hills, 6 to 8 seeds	1	1 to 2	.....	.....	.....	.....	.....	Aug. 1–15	Sept. 30 on	
Beets, early.....	8	¼lb.	.50	April 15	Drills	½–¾	¼–½	.....	.....	June 15	3	Greens	June 15–30	Aug. 1	
Beets, late.....	4, 5	½lb.	.75	July 15–30	Drills	½–¾	¼–½	.....	.....	July 1–15	4	Greens	Sept. 15–30	Oct. 15	
Brussels sprouts.	13	1 pkg.	.10	Mar. 15	Hotbed	½	½	April 15–30	18	.....	.....	.....	Aug. 1–15	Oct. 15 on	
Cabbage, early..	19	1 pkg.	.10	Mar. 15	Hotbed	½	¼–½	April 15–30	18	.....	.....	.....	July 1–15	Sept. 1	
Cabbage, late....	½ of 27	1 pkg.	.05	May 15	Coldframes	½	¼–½	June 15–30	24	.....	.....	.....	Aug. 15–30	Nov. 1 on	All winter
Cabbage, red....	¼ of 27	1 pkg.	.05	April 15	Hotbed	¼	¼–½	May 20–30	24	.....	.....	.....	July 30	Oct. 30 on	All winter
Cabbage, Savoy.	¼ of 27	1 pkg.	.05	April 15	Hotbed	½	¼–½	May 20–30	24	.....	.....	.....	July 30	Oct. 30 on	All winter
Carrots, half-long	¼ of 10	1 oz.	.25	April 15–30	Drills	¼–½	¼–½	.....	.....	June 1–15	2	Destroy	July 1–15	Aug. 15	
Carrots, long....	¾ of 10	2 oz.	.40	April 30	Drills	¼–½	¼–½	.....	.....	June 1–15	3	Destroy	July 15–30	Oct. 1–15	
Cauliflower.....	¾ of 8	1 pkg.	.20	April 15 and later	Hotbed	½	¼–½	June 20–30	18	.....	.....	.....	Aug. 1–15	Oct. 15	To store for winter
Celeriac.....	½ of 9	1 pkg.	.05	May 1	Hotbed	¼ or less	Thick	June 10–20	10 to 12	.....	.....	.....	Sept. 15	Nov. 1 on	Winter
Celery, early....	20	1 pkg.	.10	Mar. 15	Hotbed	¼ or less	Thick	May 1–10	4	.....	.....	.....	June 1–15	July 15	
Celery, late.....	18, 19	1 pkg.	.10	May 1	Hotbed	¼ or less	Thick	June 10–20	5 to 6	.....	.....	.....	Sept. 15	Nov. 1 on	Winter
Chard, Swiss....	Herb bed	1 pkg.	.10	April 15	Drills	½–¾	¼–½	.....	.....	June 15	12	Greens	June 15–30	July 15	
Corn, early.....	27	1 pt.	.20	May 15 or earlier	Hills	1	3	.....	.....	July 1–4 plants	Hills 18	Destroy	July 20–30	Aug. 5	
Corn, midseason.	28, 29	1 qt.	.30	June 1	Hills 18 in. apart	1	3	.....	.....	July 15	To 4 plants in hill	Destroy	Aug. 1–15	Sept. 1	
Corn, late.....	30	1 pt.	.15	June 15	Hills 24 in. apart	1	3	.....	.....	July 30	To 3 plants in hill	Destroy	Sept. 1–15	Sept. 30	
Cucumbers.....	⅓ of 22	1 pkg.	.10	May 15	Drills	½–¾	1	.....	.....	July 1–15	6	Destroy	Aug. 15–30	Sept. 15–30	
Eggplant.....	½ of 16	1 pkg.	.10	April 15	Hotbed	½	½	May 20–30	15	.....	.....	.....	Sept. 1	Sept. 15	
Endive.....	½ of 9	1 pkg.	.05	July 1	Drills	½	½	.....	.....	June 15	12	Greens	Sept. 15	Oct. 30	
Horse-radish....	¼ of 32	50 roots	.50	.....	.....	.....	.....	Apr. 15	12	.....	.....	.....	Nov. 1 on	Fall and next spring	Winter
Kohlrabi.....	¼ of 8	1 pkg.	.05	April 15	Hotbed	½	½	June 15–30	9	.....	.....	.....	July 30	Aug. 15–30	
Leek.....	Between tomatoes	2 pkgs.	.10	April 1	Hotbed	½	¼–½	May 1–10	3	.....	.....	.....	June 1	July 15	
Lettuce.....	In melons and elsewhere	6 pkgs.	.50	Apr.–Sept.	Hotbed and field	¼–½	¼–½	Apr.–Aug.	7x7 in. hotbed, 10 outside	.....	.....	.....	May 20–30	All seasons	
Carried forw'd	.....	.....	$10.45												

PLANTING-PLAN FOR A VEGETABLE-GARDEN 110 x 200 FEET, continued.

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Transplanting		Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed (inches)	Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Brought forw'd	.....	.....	$10.45												
Muskmelons	Bed	3 pkgs.	.40	May 15	Hills, plow	½–¾	1	.....	.....	June 15	6	Destroy	Aug. 15–30	Oct. 15	
Okra	¼ of 16	1 pkg.	.05	Mar. 15	Hotbed	½–¾	¼–½	May 15–30	12	.....	.....	.....	July 15–30	Sept. 30	
Onions	13, 14, 15, and between	3 ozs.	.45	April 1 or later	Hotbed and outside	½	¼–½	April 1–30	3	.....	.....	.....	June 1–15	Aug. 15–30	
Parsnips	11	2 ozs.	.25	April 15	Drills	¼–½	¼–½	.....	.....	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Again in spring
Peas, early	1	2 qts.	1.30	April 1	Drills	1½–2	Thick	.....	.....	.....	.....	.....	June 15–20	July 1	
Peas, midseason	2, 3, 4, 5	1 pk.	4.00	April 15	Drills	1½–2	Thick	.....	.....	.....	.....	.....	July 1–15	July 30	
Peas, late	6	2 qts.	1.00	May 30	Drills	1½–2	Thick	.....	.....	.....	.....	.....	July 30	Aug. 15–30	
Peppers	¼ of 16	1 pkg.	.05	April 1	Hotbed	½	½	May 20–30	12	.....	.....	.....	Aug. 15	Oct. 1–15	
Potatoes, early	21, 23	4 pks.	2.00	May 1	Drills	4	10	.....	.....	.....	.....	.....	June 15	Aug. 1	
Potatoes, late	24, 25, 26	1½ bu.	3.00	May 15	Drills	4	10	.....	.....	.....	.....	.....	Aug. 15–30	Oct. 15	For winter
Pumpkins	In sweet corn	2 ozs.	.20	May 15	Corn hills	¾–1	2 or 3 in every third corn hill	.....	.....	June 15	2 in hill	Destroy	Oct. 1	Oct. 15	For winter
Radishes, early	In melons and vacant places	3 ozs. in pkgs.	.30	Apr.–Aug.	Drills and hotbed	½	¼–½	.....	.....	.....	.....	.....	May 1	All seasons	
Radishes, winter	Herb bed	2 pkgs.	.10	June 1	Drills	½	½	.....	.....	June 15	2 to 6	Destroy	Sept. 1	Oct. 15	Winter
Rhubarb	¼ of 32	16 roots	2.50	.....	.....	.....	.....	Apr. 15	36	.....	.....	.....	May 15	July 15	
Salsify	12	¼lb.	.50	April 15	Drills	½	½	.....	.....	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Winter
Spinach	Early, 6, 18, late anywhere	½lb.	.25	April 1 on	Drills	½	¼–½	.....	.....	May 30 on	3	Destroy or greens	May 15–30	June 30 on	
Squash, early	⅓ of 22	2 pkgs.	.10	May 1–15	Hills 6 to 8 seeds	¾	3 to 6	.....	.....	June 15	3 or 4 in hill 3 ft.	Destroy	June 15	July 15	
Squash, late	2, ⅓ of 22	¼lb.	.40	May 15 July 1	Hills	¾	3–4	.....	.....	June 15 on	2 or 3 in hill 6 ft.	Destroy	Sept. 1	Oct. 15	Winter
Tomatoes	17	3 pkgs.	.25	April 1	Hotbed	¼–½	¼–½	May 20–30	36	.....	.....	.....	June 15–30	Sept. 15–30	
Turnips, early	9	2 ozs.	.20	April 15	Drills	½	¼–½	.....	.....	May 15	6	Destroy	June 1–15	Aug. 1–Sept. 15	
Turnips, late	20	2 ozs.	.20	July 15–20	Drills	½	¼–½	.....	.....	Aug. 1	10 to 12	Destroy	Sept. 15	Oct. 15	
Balm	Herb bed	1 pkg. each	.05	May 1–15	Hotbed	¼–½	¼–½								
Basil, sweet			.05												
Caraway			.05												
Catnip			.10												
Dill			.05												
Horehound			.05												
Mint			.25												
Sage			.05												
Savory, summer			.05												
Thyme			.05												
Total	.....	.....	$28.70												

Time for planting seeds or transplanting plants in the garden (Wilkinson).

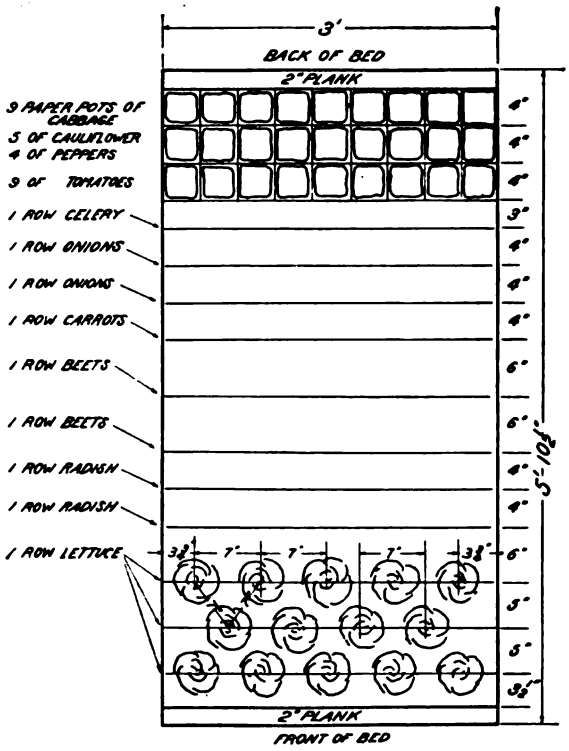
April 1–15.—Early peas (seeds).

April 15 (all seeds).—Early beets, Swiss chard, early carrots, midseason peas, radishes, parsnips, salsify, early turnips.

April 15–30 (all plants).—Early brussels sprouts, early cabbage, early kohlrabi.

May 1–10.—Early corn (seeds), lettuce (plants), endive (seeds), radishes (seeds), early celery (plants), leek (plants), onions (plants).

May 10–20 (all seeds).—Beans, green and wax; late carrots, cucumbers, late peas, early squash.



2037. Plan for the utilizing of hotbed space. (Wilkinson)

May 20–30.—Beans, shell (seeds); late beets (seeds), late squash (seeds), late turnips (seeds), cauliflower (plants), red cabbage (plants), tomatoes (plants).

June 1–10 (all seeds).—Midseason corn, lettuce, winter radishes.

June 10–20.—Late corn (seeds), late celery (plants), lettuce (seeds).

June 30.—Late cabbage (plants), late cauliflower (plants), late brussels sprouts (plants), late kohlrabi (plants), lettuce, and radishes in vacant places (seeds).

The yearly supply of vegetables (Wilkinson).

The family should plan to have for consumption, on the dates named, the following vegetables:

March 15–20 (from hotbeds).—Radishes, lettuce (leaves).

March 20–30 (from hotbeds).—Radishes, lettuce (leaves), spinach.

April 1–15 (from hotbeds).—Radishes, lettuce (head), spinach, beet greens.

April 15–30 (from hotbeds).—Radishes, lettuce, spinach, beets (small), cress, endive, parsley.

May 1–15 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce (head), spinach, beets, carrots, cress, endive, parsley, rhubarb.

May 15–30 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce, spinach, beets, carrots, cress, endive, parsley, rhubarb, asparagus, cauliflower, turnips.

June 1–15 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce, spinach, beets, carrots, cabbage, parsley, rhubarb, asparagus, cauliflower, turnips, beans, celery, leek, onions, peas.

June 15–30 (from the garden).—The vegetables named above; Swiss chard, potatoes, squash (crookneck and white), tomatoes.

July 1–15 (from the garden).—The vegetables named above; beans (wax and green), cabbage, carrots (half-long), midseason peas.

July 15–30.—The new vegetables ready between these dates are: Carrots (long), early sweet corn (outside-grown), kohlrabi, okra.

August 1–15.—The new vegetables ready between these dates are: Beans (shell), brussels sprouts, red cabbage, savoy cabbage, cauliflower (from outside), midseason sweet corn, late peas.

August 15–30.—The new vegetables ready between these dates are: Late cabbage, cucumbers (outside-grown), muskmelons, peppers, late potatoes.

September 1–15.—The new vegetables ready between these dates are: Bur, or globe, artichokes, late corn, eggplant, parsnips, winter radishes, salsify, late squash.

September 15–30.—The new vegetables ready between these dates are: Jerusalem artichokes, late beets, late celery, celeriac, turnips.

October 1–15.—Pumpkins.

October 15–30.—Herbs harvested.

The following should be supplied for storage and winter consumption: Jerusalem artichokes, beets, carrots, celery, cabbage, celeriac, potatoes, pumpkins, parsnips, winter radishes, horse-radish, salsify, squash, turnips, onions.

PAUL WORK.

The home flower-garden.

The flower-garden differentiates itself from the formal plantings which comprise the main landscape gardening features. The landscape design is for general effect; the flower-garden a more intimate, homely affair, the outgrowth of a real love of flowers and their associations.

Usually it will lie within the province of the housewife to plant and cultivate the flower-garden and, for this reason, its location is of first importance. It should be convenient of access, secluded in a measure, that one may work in odd moments and odd habiliments, if convenient, and should be considered from the standpoint of convenience and personal preference. Nothing should be planted merely for show or ornament, although nothing need be left out because it is ornamental, but the flowers which most appeal to one, either from certain qualities they possess or from sentiment or association, should be much in evidence.

The platting of the garden should be on a practical working basis, with ample beds of straight outlines, with broad well-constructed paths that do not end in cul-de-sacs but afford ample room at their angles for the turning of a hand barrow or cart, for paths are not intended merely to separate the parts of the garden or to facilitate strolling in the cool of the evening, but they serve the very utilitarian purpose of a working basis for the beds. Gravel, cinders or earth paths which have been treated with a good herbicide, are preferable; if they are properly treated they will practically take care of themselves from season to season.

While the form of the plat and individual preference will usually determine the outlines of the garden, no form is more satisfactory and ample than that of beds

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PLANTING-LIST OF ANNUALS.—(A. C. Hottes, New York).

Name, Botanical and Common	Height	Color	Distance apart	Season	Remarks.
Ageratum Houstonianum, Floss Flower	8 in.	Purplish blue, white	6–9 in.	July, Aug.	Best blue hardy annual for edging.
Alyssum maritimum, Sweet Alyssum	8 in.	White	5 in.	July to frost	One of the best white, hardy annuals for edging.
Amarantus caudatus, Love-Lies-Bleeding	3 ft. +	Scarlet to yellow	15 in.	June	Tender; rather gaudy.
Antirrhinum majus, Snapdragon	1–4 ft.	Various	1–1½ ft.	July–Sept.	Sow in February for early bloom; cut-flower; hardy.
Arctotis grandis, African Daisy	1½ ft.	White, lilac	12–18 in.	June to frost	Hardy; petals white above, lilac beneath; blue center; daisylike.
Brachycome iberidifolia, Swan River Daisy	½–1 ft.	Pale blue or white	9–12 in.	July	Half-hardy; plant in heat for early bloom; pretty little plant.
Browallia demissa, Amethyst	1 ft.	Blue, white	9 in.	All summer	Tender; excellent planted among other annuals.
Calendula officinalis, Pot Marigold	12–18 in.	Orange, yellow, sulfur	12–18 in.	May to frost	Hardy; masses or borders.
Callistephus chinensis, China Aster	2 ft.	Various	9–12 in.	July to frost	Half-hardy; start indoors; partial shade or sun; cut-flower.
Celosia cristata, or Cockscomb	1 ft.	Various	9–12 in.	June to frost	Tender; cutting; border; moisture-loving.
Centaurea Cyanus, Bachelor's Button	1½–2 ft.	Blue-white, pink	12 in.	May to frost	Hardy; water and pick flowers, to prolong season of bloom.
Centaurea moschata, Sweet Sultan	2 ft.	White, yellow, purple	6–10 in.	June, through Aug.	Hardy; cut-flower; have bloom before hot weather.
Clarkia elegans, Clarkia	1–3 ft.	White, lilac, pink	8–12 in.	June–Sept.	Hardy; warm light soil; sun or partial shade.
Coreopsis tinctoria, Calliopsis	2 ft. +	Yellow, brown	8–10 in.	May to frost	Hardy; self-sows; good for cutting; sun.
Cosmos bipinnatus, Early Cosmos	4 ft. +	White, pink, crimson	12–15 in.	Late July to frost	Hardy; choose earliest varieties; not too rich soil.
Delphinium Ajacis, Annual Larkspur	1½ ft.	Various	6–12 in.	June, July	Hardy; sun; good for cut-flowers.
Dianthus chinensis, Chinese Pink	10–16 in.	Pinks, reds, combin	6–8 in.	July to frost	Hardy; scentless; really a biennial.
Eschscholtzia californica, California Poppy	15 in.	Yellow, pink, white	6–8 in.	July	Sun; sow early; do not transplant; tender.
Gaillardia pulchella, Blanket Flower	1–2 ft.	Crimson, red, yellow	10–12 in.	July to frost	var. picta, free-blooming; hardy; cutting.
Godetia amœna, Satin Flower	1–2 ft.	Red, white combin	8–12 in.	July–Oct.	Hardy; satiny luster.
Gomphrena globosa, Globe Amaranth	1–1½ ft.	Pink, purple, White, orange	1 ft.	July, Aug.	Hardy, cutting; masses; an everlasting.
Gypsophila elegans, Baby's Breath	1–1½ ft.	White	12 in.	July	Hardy; sow for succession of bloom; cut to combine with other flowers.
Helianthus annuus, Sunflower	2–10 ft.	Golden yellow	2–4 ft.	Aug. to frost	Hardy; background screen.
Helichrysum bracteatum, Everlasting	3 ft.	Deep red, white, yellow	10–12 in.	July to frost	Hardy; sun; gather flowers at night to preserve form.
Iberis amara, Candytuft	6–18 in.	White, crimson, carmine	6–9 in.	July to frost	Hardy; successive sowings two weeks apart prolongs season; sun.
Impatiens Balsamina, Lady Slipper	1–2½ ft.	Various	9–12 in.	July to frost	Half-hardy; sun; sandy loam.
Lavatera trimestris, Annual Mallow	2 ft.	Pink, white	12 in.	July	Hardy; sow early, May, where they are to grow.
Linum grandiflorum var. coccineum, Scarlet Flax	1–1½ ft.	Scarlet	8–10 in.	July	Half-hardy; glossy red; is attractive; not good when cut.
Lupinus hirsutus, Hairy Lupine	2–3 ft.	Blue, pink, white	6–8 in.	July–Aug.	Hardy; massing; cut-flowers; hairy.
Matthiola incana var. annua, Stock	1½ ft.	Various	6–12 in.	July–Sept.	Half-hardy; for early bloom start indoors; fragrant.
Nicotiana alata, Ornamental Tobacco	3–5 ft.	White	12–18 in.	July to frost	Hardy; start indoors; fragrant in evening; massing.
Nigella damascena, Love-in-a-Mist	1–2 ft.	Blue, white	10–12 in.	June–Sept.	Hardy; flowers surrounded by attractive foliage.
Papaver Rhœas, Shirley Poppy	2 ft.	Various	4 in.	June–Sept.	Hardy; sow very thinly September or April.
Papaver somniferum, Opium Poppy	2½ ft.	Various	4–5 in.	June–Sept.	Hardy; massing.
Petunia hybrida, Petunia	1 ft.	Various	1 ft.	June to frost	One of the most freely blooming annuals; half hardy.
Phlox Drummondii, Annual Phlox	1 ft.	Various	6–8 in.	June	Hardy; benefited by starting inside; massing in beds.
Portulaca grandiflora, Rose Moss	6 in.	Various	6–8 in.	July–Oct.	Hardy; sun; will thrive in dry soil.
Reseda odorata, Mignonette	1–1½ ft.	Reddish yellow	9 in.	July–Sept.	Hardy; fragrant; cutting; sandy soil.
Ricinus communis, Castor Bean	5–7 ft.	Green and bronze foliage	2½–ft.	July to frost	Half-hardy; tropical; screening; foliage plant.
Salpiglossis sinuata, Painted Tongue	1½ ft. +	Various	9–12 in.	July–Aug.	Half-hardy; sow indoors for early bloom; sun; rich soil.
Salvia splendens, Scarlet Sage	3 ft. +	Scarlet	8–12 in.	July to frost	Half-hardy; sun or half shade; start indoors, March; not too rich soil.
Scabiosa atropurpurea, Mourning Bride	2½ ft. +	Various	12–15 in.	Aug. to frost	Hardy; sow indoors for earlier bloom; sun; cut-flowers.
Schizanthus pinnatus, Butterfly Flower	2 ft. +	Yellow, lilac, rose, etc.	12 in.	July, Aug.	Hardy; masses; borders; cut-flowers.
Tagetes erecta, African Marigold	3 ft.	Golden yellow to sulfur	12–18 in.	July	Hardy; scented foliage; massing.
Tagetes patula, French Marigold	1–1½ ft.	Golden yellow to maroon	6–10 in.	July	Hardy; excellent edger.
Tagetes signata var. pumila, Dwarf Marigold	9–11 in.	Golden yellow	8–10 in.	Aug. to frost	Hardy; excellent edger.
Torenia Fournieri, Wishbone Flower	8 in.	Blue, white	8–12 in.	July–Sept.	Tender; urns and hanging-baskets.
Tropæolum minus, Tom Thumb Nasturtium	6 in.	Various	9 in.	July to frost	Half-hardy; cut-flowers; massing; sun.
Verbena hybrida, Verbena	1 ft.	Various	10–12 in.	July to frost	Hardy; sow indoors for early bloom; from cuttings less fragrant.
Zinnia elegans, Youth and Old Age	3 ft.	Red, yellow, magenta and combin	1 ft.	July to frost	Hardy; stiff but easily grown.

PLANTING-LIST OF HARDY HERBACEOUS PERENNIALS.—(A. C. Hottes, New York).

Name, Botanical and Common	Height	Color	Distance apart	Season	Remarks
Achillea Ptarmica, The Pearl	2 ft.	White	18 in.	June	Var. Pearl, double; confine, else it overruns garden.
Aconitum Napellus, Monkshood	3–4 ft.	Blue, white	10–15 in.	July, Aug.	Borders; root poisonous; partial shade; seeds difficult to germinate.
Adonis vernalis, Spring Adonis	6–9 in.	Yellow	12 in.	March	Do not disturb often: propagated by seed or division.
Althæa rosea, Hollyhock	4–6 ft.	Various	3 ft.	July–Sept.	Sun; plant in spring; single and double; standard background.
Anemone japonica, Japanese Anemone.	3–6 ft.	Rose, white	18 in.	Sept., Oct.	Excellent; one of best; sun or shade; standard fall border perennial.
Anthemis tinctoria, Golden Marguerite.	1 ft.	Yellow	12 in.	June to frost	Sun; divide annually; var. Kelwayi best.
Aquilegia chrysantha, Long-spurred Columbine	2–2½ ft.	Yellow	8–15 in.	June, July	Dainty and graceful; border; sun.
Boltonia latisquama	4–5 ft.	Blue, pink, violet	3–4 ft.	Late Aug.	Sun; remains in bloom several weeks; spreads rapidly.
Campanula carpatica, Harebell	6–9 in.	Deep blue	9–12 in.	July–Oct.	Edging border; sun; little bloom in fall.
Campanula Medium, Canterbury Bell.		Blue, white, pink.	1–1½ ft.	June.	Biennial; requires protection.
Campanula persicifolia, Peach-leaved Campanula	2–3 ft.	Blue or white	1–1½ ft.	June	Border; sun; rich soil.
Chrysanthemum coccineum, Pyrethrum	1–2 ft.	Various	12 in.	Aug. to frost	Needs protection in U. S.; light soil: sun; leave undisturbed two or three years.
Clematis recta, White Bush Clematis.	3–4 ft.	White	2½–3 ft.	June–Aug.	Border; dig deeply; give roots plenty of room.
Coreopsis grandiflora	1½–2 ft.	Golden yellow	15 in.	July	Cut-flower; border; keep seeds picked.
Delphinium formosum, Larkspur	4–5 ft.	Blue	2½ ft.	June–Sept.	Sun; rich, well-drained, rather heavy soil; if cut down after blooming will bloom again.
Dianthus barbatus, Sweet William	12–18 in.	Various	8–12 in.	June	Old-fashioned; still charming.
Dianthus plumarius, Grass Pink	8–12 in.	White to purple	8–12 in.	June	Rock-garden; beds; sun; rich soil.
Dicentra spectabilis, Bleeding Heart	15–24 in.	Rosy purple	15–18 in.	May, June	Warm soil; sun or shade; graceful; border; an old favorite.
Dictamnus albus, Gas Plant	12–15 in.	Purple, pink, white	12 in.	June	Remains a permanent border feature; will grow in partial shade.
Digitalis purpurea, Foxglove	1½–3 ft.	Pink and white	15 in.	June	Good foliage; sun or shade; var. gloxiniæflora best.
Eryngium amethystinum, Globe Thistle	3–4 ft.	Slate-blue	12–15 in.	July–Sept.	Attractive foliage and thistle-like heads; often dried for winter bouquets.
Filipendula hexapetala, Meadow Sweet.	12–18 in.	White	18 in.	June	Large clumps; fine foliage.
Gaillardia aristata, Blanket Flower	1 ft.	Yellow, maroon center	12–18 in.	June to frost	Keep flowers picked; sun.
Gypsophila paniculata, Baby's Breath.	2 ft.	White	18 in.	Aug.	Sun; fine flowers; excellent in bouquets.
Helenium autumnale, Sneezewort	4–6 ft.	Yellow	18–24 in.	Late Aug.	Border; sun.
Helianthus decapetalus var. multiflorus, Sunflower	4–6 ft.	Yellow	18–24 in.	Late Aug. Sept.	Good clumps; border; screening.
Hesperis matronalis, Sweet Rocket	3 ft.	White, magenta, purple	12–18 in.	July	Border; showy
Heuchera sanguinea, Coral Bells	12–15 in.	Crimson, white	12 in.	June	Sun; edging; resembles bishop's cap; long graceful spikes of bloom.
Iris germanica, German Iris	12–18 in.	Various	6 in.	June	Sun or half shade; wide range of adaptability.
Iris lævigata, Japanese Iris	18–30 in.	Various	6–12 in.	July	Requires abundance of water; sun.
Iris pumila, Dwarf Iris	6–8 in.	Purple	5–6 in.	June	Medium loam.
Iris sibirica, Siberian Iris	15–24 in.	Blue, white	6–12 in.	June	Moist soil.
Lobelia cardinalis, Cardinal Flower	2–3 ft.	Brilliant cardinal	12 in.	Aug.	Moist soil; sun or half shade.
Lychnis chalcedonica, Maltese Cross	3 ft.	Brilliant red	12 in.	July to frost	Showy; border; also called campion and lamp flower.
Lychnis Viscaria, German Catchfly	9 in.	Deep red, white	9–10 in.	June	Sun; long-lived.
Mertensia virginica, Virginia Cowslip	16 in.	Blue	Clumps	April	Leave undisturbed; foliage dies after flowering.
Monarda didyma, Bee Balm	3 ft.	Red, scarlet	12 in.	July	Sun; spreads rapidly.
Myosotis palustris, Forget-me-not	½–1 ft.	Blue, white	8–10 in.	May, June	Moisture; shade or sun if not dry; var. semperflorens is very good.
Œnothera missouriensis, Missouri Evening Primrose	6–9 in.	Yellow	8–10 in.	Aug.	Large flowers; showy.
Pæonia officinalis, Peony	2 ft.	Red, white	3 ft.	May	Heavy soil; sun; old-fashioned "piney."
Pæonia albiflora, Chinese Peony	3 ft.	Various	3–4 ft.	June	Sun; deep, rich soil.
Papaver nudicaule, Iceland Poppy	12–18 in.	White, yellow, orange	6–8 in.	May–Sept.	Edger; blooming intermittently through season.
Papaver orientale, Oriental Poppy	2–3 ft.	Red, scarlet	12–18 in.	June–Aug.	Mixed border; gorgeous colors; after flowering the plants rest and foliage dies down.
Pentstemon barbatus, Beard Tongue	1½–3 ft.	Light pink to carmine	9–12 in.	June, Aug.	Var. Torreyi; sun; rich; grown in masses. [colors.
Phlox paniculata, Hardy Phlox	3–4 ft.	Various	12–18 in.	June, July	Indispensable; clumps; choose good
Phlox subulata, Moss Pink	12 in.	Lavender	8–12 in.	April	Excellent for rockery or border.
Platycodon grandiflorum, Chinese Balloon Flower	3–3½ ft.	Blue, white	12–18 in.	Aug.	Showy; border; cut-flower.
Polemonium cæruleum, Jacob's Ladder	1–2 ft.	Blue, white	12–18 in.	June	Likes moisture; sun or partial shade; border; finely cut foliage.
Rudbeckia laciniata, Golden Glow	4–6 ft.	Yellow	12–18 in.	Late Aug., Sept.	Excellent background; easily grown.
Sedum spectabile, Showy Sedum	15–18 in.	Pink	8–10 in.	Aug.	Showy; sun; rich soil.
Stokesia cyanea, Stokes' Aster	12–18 in.	Blue, white	12 in.	Aug.	Sun; light soil; masses; border; cut-flower.
Trollius europæus, Globe Flower	12–18 in.	Yellow	12 in.	May, June	Moist heavy loam; buttercup-like flowers; best in half shade.
Viola cornuta, Horned Violet	6–8 in.	Blue, white	12 in.	May	Masses; rich soil.
Yucca flaccida, Hardy Yucca	5 ft.	White	2 ft.	June	Transplant early spring; sun; light soil.

NOTE.—In the column "distance apart," the distance indicated is for first year; nearly all plants will need frequent division of clumps, placing them at greater distances apart.

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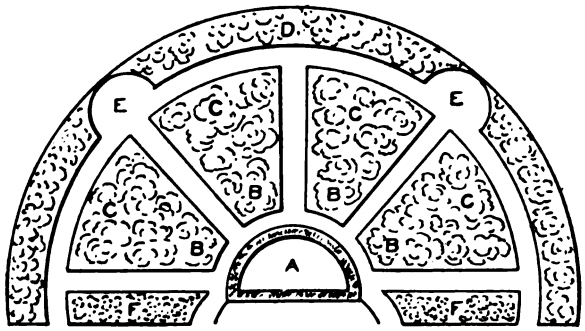
radiating from a common center. Such beds provide the greatest amount of growing room with the least waste, and they bring all parts of the garden into view, without the defect of nearby beds shutting out the view of those in the rear. Such a garden is shown in Fig. 2038, with turning-places and outlooks at EE.

If the home flower-garden comprises the whole of the floral planting and no other space is devoted to shrubbery and the more robust kinds of perennials, then these radiating beds furnish the very best form in which to combine them with the landscape garden proper. Starting from a central point, A, which may be conspicuous by a pool, a bit of sod with table and seat or any garden furnishing, the beds, which may be as narrow



2038. A serviceable plan for a home flower-garden.

as 1 foot at the point, widen gradually as they recede until, at the circumference, they attain considerable width; these rear parts are excellent for the planting of shrubbery and tall perennials, and shrubs may extend upward through the center of the rear parts of the beds; tall perennials may be massed at the sides and in front, lower perennials border these, and annuals and edging plants fill out the remainder of the ground, in this way furnishing a massed planting which is very attractive and also economical of space. The diagram (Fig. 2038) is a very good example of this manner of platting, and it may be adopted in its entirety or simplified by omitting the outer circle and the two short beds in front.

When economy in labor is of moment, it will be well to choose those plants whose manner of growth is clean and neat, rather than those that tend to spread and so require much cutting and restraining. Lilacs, for example, require constant grubbing out, while the lespedeza has an attractive erectness and cleanness of manner and requires no pruning or restraint; this, also, is true of the altheas and spireas in the main, while the deutzia is easily kept to the single plant if desired.

Lilies, which do their best when planted among shrubbery and perennials, should be used abundantly in the home-garden, especially the candidum and auratum lilies. For summer cut-flowers, few things equal in effectiveness and usefulness the gladiolus; and as this flower is at its best when interspersed among more generously foliaged plants, it may be worked in among tall perennials to good advantage. Perennial poppies are one of the valuable garden assets and, once established, continue to give satisfactory returns for years. They combine effectively with the Shasta daisies, and are specially effective against the green backgrounds of taller plants. The dictamnus is valuable and should find a place in the home-garden, as once established it is practically everlasting; and its manner of growth is so erect and neat, its bloom so satisfactory and attractive that it is well worth adopting.

A garden laid out as indicated and planted in the rear and central parts with permanent things, leaves abundant room in front and along the margins for annual plants and for experiments in novelties from year to year. It will have its shady and sunny spots which may be utilized for plants requiring special conditions of exposure.

Certain old garden favorites among the annuals will be much in evidence, but a study of the catalogues of the leading florists will show vast improvements in type which may be adopted without in any way detracting from the old-time sentiment of the flowers. Asters and pansies, especially, show this advancement, and petunias are much superior to the small kinds of a few years ago. In purchasing seed of these flowers it is economy to buy the most expensive, as the results well repay the extra outlay. From 25 to 50 cents a packet for pansies and petunias is none too much if one would secure notable flowers.

The home-garden should be beautiful and interesting from early spring until frost, and to secure this result one must plant freely along the margin of the beds of spring-blooming bulbs—crocus, tulips, hyacinths, narcissi and the like. These bulbs do admirably planted in long, triple rows, and the space between them may be filled in summer with candytuft, ageratum, schizanthus, Drummond phlox, verbena, petunia.

Sufficient plants that bloom late in summer and in autumn should be supplied to make the garden attractive at this time. Anemones are the most charming of autumn flowers, hardy chrysanthemums bloom well into November, tritomas or kniphofias are a blaze of color for weeks. By judicious planting there need be no dearth of color in any season.

Preparing the ground for the flower-garden.

The preparation of the ground, especially when the planting is to be of a permanent character,—that is of shrubbery, perennials and hardy bulbs,—is of great importance, as any defects in quality of mechanical condition of the soil will not be easily rectified, once the planting is accomplished.

Good drainage is the first consideration, as this must be performed before any platting or bed-making is attempted. When the lay of the land makes for a natural removal of surplus moisture, or the soil is sandy and underlaid with gravel, no artificial drainage will be required; but when the soil is cold and sour and retentive of too much moisture it will be necessary, for the best results, to lay two or more courses of porous drain-tile underneath the plot.

If the garden is large enough to admit of an initial plowing, this way of preparing the soil may put it in better mechanical condition than spading, although, of course, after the beds are laid out and paths established, spading will be the only feasable method of working the ground. When the soil is naturally good, as in breaking up a piece of sod land or in a well-fertilized garden spot, it will be necessary only to spade or work up the beds, incorporating a liberal quantity of old well-rotted manure. A very satisfactory way of working manure into beds is to begin at one side of the bed and spade one row, laying the soil one side so as to leave an open trench; fill this trench full of manure and spade the next row on top of this, and so continue till the entire area is covered. This buries the manure well beneath the surface and effectively prevents the germination of weed seeds; at the same time the manure deep in the soil holds the moisture and brings the roots well down beneath the surface where they remain cool and moist. See p. 1739, trenching.

In beds that are to be worked over but not fertilized the second summer, it is not desirable to turn the soil over in spading as this throws the manure back to the surface; but sufficiently satisfactory results are secured by thrusting the spade well down into the ground and turning it around, but not lifting it out. A bed worked over in this way will be in excellent condition and less disturbance and cutting of the roots will result.

A garden planted to shrubs and perennials may

safely be left undisturbed for three years, providing a good annual stirring of the soil is given in early spring followed by sufficient tillage to establish a dust-mulch throughout the dry weather. Getting down on hands and knees and working around each individual plant with a trowel has many advantages, as it puts one more intimately in touch with the plant than is possible with hoe and spade. Many ambitious little shoots succumb to the onslaught of a too vigorous hoe, that might have been saved by a closer inspection. The presence of insect enemies about the base of the plants is likely to pass unnoticed until much damage is done, when only a standing cultivation is practised; so, one intimate acquaintance with each inmate of the garden is advised at least once a year, preferably in early spring.

For the remainder of the summer, dependence may be placed on any one of the various forms of hoes, preferably the scuffle-hoe, as by the use of this tool one can work closer to the stem of the plants, slipping beneath the leaves and recumbent foliage with little damage. It produces the most perfect dust-mulch of any tool and as it is used walking backward no footprints are left on the soil to press a weed back into the ground where it may grow again, as is the case with a wheel-hoe or most hand-hoes, and last, it is the tool best adapted to a woman's use and with it she can accomplish a large amount of labor with little fatigue. A good trowel is essential. In buying this everyday implement, the gardener should choose one in which the blade and handle are in one piece of steel, for a handle riveted or secured to the blade is always unsatisfactory and of short duration. Pruning shears that open easily and fit the hand well are also necessary when shrubs or roses are cultivated. These three articles, together with a spade and rake are about all the indispensable tools aside from a good wheelbarrow and one or more baskets of convenient size.

When the garden plat is confined with an ornamental wooden fence, painted white as is so much the custom, a good effect is gained by planting tall-growing shrubs in the rear to reach over the fence, furnishing a charming background of bloom and greenery.

Tall-growing shrubs that make their growth mostly at the crown are especially desirable, as for example, the dogwood, flowering thorns, red-buds, tree lilacs and the tamarix. Shrubs which bloom from the ground up are wasted in the flower-garden. Altheas, syringas, deutzias, spireas, symphoricarpos, Tartarian honeysuckles, weigelas, snowballs and the like need an open place in which to display their merits to the best.

As the buying of any great quantity of perennial plants calls for a considerable initial outlay, it is both economical and interesting to grow them from the seed. The seeds may be started in hotbeds in early spring and transplanted into the beds where they are to grow as soon as large enough; or, what may be the better way for many kinds, they may be sown in long rows in the vegetable-garden, where they will receive the same cultivation as the vegetables and be transplanted the following spring. Oriental poppies do especially well under this treatment. Shasta daisies and delphiniums should be planted, but physostegias, hibiscus, aquilegias, achilleas, sweet Williams, dianthus, digitalis, gauras, sunflowers, hollyhocks, may be produced by the hundreds at a very trifling expense.

Annuals that are desired merely for cutting may also be grown in the vegetable-garden to advantage. Asters, sweet peas, cosmos, arctotis, annual larkspurs, centaureas, cornflowers, gaillardias, all the everlastings, may very profitably be relegated to this economic culture and so leave room for more permanent things in the garden proper.

IDA D. BENNETT.

KITCHÍNGIA (personal name). *Crassulàceæ*. Succulent glabrous perennial herbs, allied to Bryophyllum but with small calyx and diverging carpels: sts. flexuose, bearing many opposite sessile or stalked fleshy crenate lvs.: fls. large for the plant, bright red, terminal, often in loose racemes, the parts in 4's; calyx-segms. as long as tube; corolla-tube campanulate or tubular, sometimes larger in middle, with 4 short lobes; stamens 8: carpels 4, free, making small many-seeded follicles.—Species 10, in Madagascar. *K. uniflòra*, Stapf, is an attractive prostrate sedum-like plant, rooting at the joints: lvs. obovate and obtuse, less than 1 in. long, bright green: fls. solitary or 3 together, bright red, the corolla-tube narrowed at both apex and base, about 1 in. long and half as thick; stamens polymorphic. B.M. 8286. R.H. 1913, p. 177.—A recent species, suitable for temperate conditions under glass.

L. H. B.

KLEÌNIA. Of the three genera of Compositæ of this name, two are referred to Porophyllum and Jaumea, but the trade names will be accounted for under *Senecio*.

KLÙGIA (Dr. Fr. Klug, German zoölogist). *Gesneriàceæ*. About 4 blue-fld. herbs, rooting at the base and more or less succulent, suitable for growing in the greenhouse. Lvs. alternate, or sometimes nearly opposite and one of the pair reduced to very small size, the sides of the lf. unequal, many-nerved, sinuate or nearly entire: fls. opposite the lvs. or terminal, small and pendulous, short-stalked; calyx 5-angled or 5-winged, one wing often larger than the others, the lobes of calyx 5; corolla-tube cylindrical, 2-lipped, the upper lip very small and the lower rounded or somewhat 3-lobed; stamens 4, perfect: fr. a 2-valved caps. included in the calyx. India, and 1 species in Mex. *K. Notoniàna*, A. DC. Quick-growing herbaceous annual, 12–18 in., more or less puberulent: lvs. petiolate, ovate, acuminate, 5–8 in. long: corolla-tube white, ½in. long; large lower lip blue, with yellow at the base; calyx-lobes short and triangular, and one wing larger. India, 2,000–5,000 ft. altitude; variable. Blooms under glass, Jan. to summer. G.C. III. 19:237. *K. zeyldnica*, Gardn., differs in the long-acuminate calyx-lobes and the wings of calyx nearly equal. Ceylon. B.M. 4620 (as *K. Notoniana*).

L. H. B.

KNIPHÒFIA (Johann Hieronymus Kniphof, 1704–1765, professor at Erfurt). Syn., *Trìtoma*. *Liliàceæ*. TORCH-LILY. RED-HOT-POKER PLANT. FLAME-FLOWER. Excellent showy perennial herbs grown in the open (some species under glass), with spikes or racemes of long, drooping red and yellow (rarely white) flowers.

Herbs with abundant radical lvs. and stout, simple naked scapes or peduncles, the thick roots from a short vertical rootstock, mostly stemless but a few species with a short caudex below the crown of lvs.: fls. many, in a spike-like raceme or dense head-like spike, on short articulated pedicels; perianth funnel-shaped or cylindrical, the tube long and the nearly or quite equal segms. small and mostly broad; stamens 6, in two lengths, equaling or exceeding the perianth; ovary 3-celled, bearing a filiform style and capitate stigma: fr. a short 3-valved caps.—Species probably 70, in Trop. and S. Afr. in the tropical regions mostly from high elevations. The genus is rich in good native forms, many of which are scarcely known in general cult., and it is to be expected that important horticultural developments will arise in the future. Accounts of the species described to those dates will be found in Flora Capensis (1896–7) and Flora Tropical Africa (1898) in the treatments by Baker, from which the present descriptions have been largely drawn. These descriptions are made mostly from wild plants and therefore may not apply to garden forms, which are very likely to be hybrids.

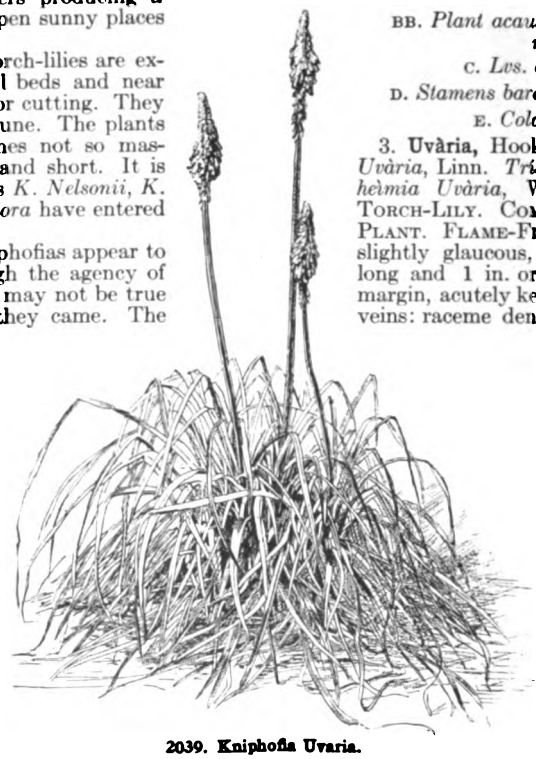
The kniphofias are among the most showy of border plants. They are essentially autumn bloomers, but some of the newer kinds are nearly continuous bloomers

from midsummer. The common kinds are hardy south of Philadelphia when well covered in winter, but in the North it is usually safer to dig up the plants in November, place them in boxes with dry earth, and store them in a cellar in winter. In spring place them in a warm, sheltered, well-drained spot, perhaps with a background of shrubbery to set off the flowers. Some of the recent species from tropical Africa are treated as greenhouse or warmhouse subjects. In general cultivation the prevailing species is *K. Uvaria*. This is nearly hardy North, has sword-shaped leaves 2 to 3 feet long, and several scapes 4 or 5 feet high surmounted by a spike 4 to 8 inches long composed of perhaps 100 tubular, drooping flowers, each 1 inch or more long, and fiery red. It has perhaps a dozen varieties with Latin names and twice as many with personal names. Most other species have much the same general effect, and recent variations and apparent hybrids have greatly extended the blooming season and the range of color and form. For producing mass-effects, the torch-lilies are among the most striking subjects, the brilliant flowers producing a flame of color. Clumps in open sunny places are particularly emphatic.

The miniature-flowered torch-lilies are excellent for planting in small beds and near the front borders and also for cutting. They begin to bloom as early as June. The plants are mostly small, the racemes not so massive, and the flowers small and short. It is probable that such species as *K. Nelsonii*, *K. pauciflora*, *K. rufa*, *K. breviflora* have entered into them.

Under cultivation, the kniphofias appear to hybridize very freely through the agency of bees, and seedlings therefore may not be true to the parent from which they came. The result is that there is much confusion in the literature of the genus, and it is often very difficult to trace the original species-forms.

They grow readily from seeds, and novel forms are likely to be secured from the mixed garden parentage. The plants should bloom freely the second year, and often the first year. The usual method of propagation is by division; the caulescent kinds, however, may not produce offsets or divisible parts readily unless they are headed back or cut off to make them spread. Kniphofias are often classed by dealers as bulbous plants, though they have only a short rhizome and numerous, clustered, thickish root-fibers. Old but vigorous plants of the *K. Uvaria* kind divide easily, and give large strong pieces.



2039. Kniphofia Uvaria.

INDEX.

alooides, 3.
aurea, 18.
breviflora, 16.
Burchellii, 5.
carnosa, 3.
caulescens, 1.
citrina, 23.
comosa, 17.
corallina, 11.
floribunda, 3.
foliosa, 27.
glauca, 3.
glaucescens, 3.
gracilis, 22.
grandiflora, 3.
grandis, 3.
kewensis, 10.
Leichtlinii, 18.
longicollis, 6.
longiflora, 13.
Macowanii, 11.
maroccana, 11.
maxima, 3.
media, 11.
modesta, 14.
multiflora, 19.
natalensis, 12.
Nelsonii, 10.
nobilis, 3.
Northiæ, 2.
pauciflora, 20. [list.
Pfitzeri, 3; also suppl.
praecox, 3.
primulina, 8.
pumila, 21.
Quartiniana, 27.
refulgens, 3.
rigidissima, 11.
Rooperi, 4.
rufa, 24.
sarmentosa, 7.
Saundersii, 3.
serotina, 3.
sparsa, 15.
triangularis, 9.
Tuckii, 25.
Tysonii, 26.
Uvaria, 3.

A. *Perianth long, an inch or more.* (*Nos. 1–15.*)

B. *Plant caulescent* (*a st. or caudex below the lf.-crown*).

1. **caulèscens,** Baker. Plant with a thick st. below the lvs., 6–12 in. long: lvs. very glaucous, sword-shaped-acuminate, broadly channelled, not acutely keeled on the back, 2–3 ft. long, 2–3 in. wide, margin serrulate: spike about ½ ft. long, 3 in. thick; lower fls. yellow, upper ones red; segms. broad, ovate and obtuse, very short; stamens and style somewhat exserted. Cent. Cape region. B.M. 5946. G.C. III. 6:564. R.H. 1887:132 (as *Tritoma caulescens*). Gn. 41:536; 78, p. 502. G. 36:83. Gn.W. 16:443. G.M. 57:555.

2. **Nórthiæ,** Baker. St. short, 2–3 in. diam.: lvs. 30–40, in a dense rosette, 4–5 ft. long and 5–6 in. broad, lance-acuminate, channelled on the face, not sharply keeled, margins serrulate: raceme or spike 1 ft. and more long, very dense, on a peduncle shorter than the lvs.; fls. 1 in. long, the lower ones yellow and the upper ones red toward the tip; segms. small and ovate; stamens becoming much exserted. Coast region. S. Afr. B.M. 7412. G.C. III. 39:100. Gn. 73, p. 480.

BB. *Plant acaulescent* (*no caudex below the mass of lvs.*).

C. *Lvs. ensiform-acuminate.*

D. *Stamens barely exserted in full anthesis.*

E. *Color of lvs. dull green.*

3. **Uvària,** Hook. (*Alòe Uvària*, Linn. *Áletris Uvària*, Linn. *Tritoma Uvària*, Ker-Gawl. *Veltheìmia Uvària*, Willd. *K. alooides*, Moench). TORCH-LILY. COMMON POKER PLANT. POKER-PLANT. FLAME-FLOWER. Figs. 2039, 2040. Lvs. slightly glaucous, ensiform-acuminate, 2–3 ft. long and 1 in. or less broad, scabrous on the margin, acutely keeled, with 30–40 close vertical veins: raceme dense, often 6 in. long, 2½–3 in. thick, on a peduncle as long as the lvs.; upper fls. bright red, lower ones yellow; perianth cylindrical, to 1½ in. long; segms. ovate and obtuse; stamens in the lower fls. barely exserted. General Cape region. F.S. 13:1393. B.M. 758; 4816.—The following varieties with Latin names are in the trade and usually advertised as apparent species under Kniphofia or Tritoma. They may be all more or less distinct horticulturally. Var. **carnòsa,** in Gn. 19:548, with the fls. opening from the top instead of the bottom, and with red filaments and yellow anthers. Leichtlin intro. it about 1881 and said it grew 1½–2 ft. high, the apricot-red of the fls. toned down by a glaucous bloom. (Cf. No. 17.) Var. **floribúnda** is early-flowering. Var. **glaùca** is apparently a trade name. Var. **glaucéscens** is figured in Gn. 36:458 with a spike 9 in. long, of "vermilion-scarlet fls. changing to a more orange color; one of the freest bloomers. Intro. 1859." Foliage somewhat glaucous. Var. **grandiflòra,** one of the earliest improvements on the type: 2–3 ft. high. Var. **grándis.** Large-fld.; fls. red and yellow, 5 ft. The plant in the trade as *K. Pfitzeri* probably belongs here; see also suppl. list, p. 1755. Var. **nóbilis** is said by Carrière, R.H. 1885:252, to have shorter and stricter lvs. than var. *Saundersii*, the spikes more ovoid, the fls. uniformly red and less deflexed. Lvs. not glaucous. Gn. 55, p. 167. Var. **Saùndersii,** in R.H. 1882:504, is shown with "red-orange fls." in an elliptical spike and said to grow 6 ft. and more

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high. It grows 4–6 ft. high in rich soil, the peduncles less rigid than in *K. Uvaria* (blooming late) with cylindrical spikes 18–24 in. long and fls. often ½in. across. Gn. 71, p. 492. See var. *maxima*, below.

Baker's treatment of the botanical varieties (under *K. aloöides*) is as follows (Fl. Capensis, VI, p. 283):

Var. **máxima** (*Trítoma grandiflòra*, Hort. *T. Saùndersii*, Carr.). More robust: lvs. 4–5 ft. long, 1 in. wide: raceme and fls. longer; stamens more decidedly exserted. B.M. 6553 (fls. yellow, more or less tinged red). R.H. 1882:504 (colored like the type).

Var. **nóbilis** (*Trítoma nóbilis*, Guill.). Still more robust: scape including raceme sometimes 6–7 ft. long; fls. 1½ in. long. R.H. 1885:252.

Var. **serótina**, Hort. A late-flowering form with slender perianth 1¼ in. long and distinctly exserted stamens. Baker also mentions var. **carnòsa**, **glaucéscens** and **refúlgens** without discrimination. Other varieties with Latin names are mentioned in Gn. 36:458. *K. prècox*, Baker, is probably not in cult.: fls. sometimes in summer and sometimes in autumn.

4. **Roòperi**, Lem. Lvs. ensiform-acuminate, 4 ft. long, and to 1½ in. broad, scabrous on the margin, acutely keeled, glaucous: raceme to 6 in. long, very dense, on a stout stiff peduncle as long as the lvs.; fls. paler than in *K. Uvaria* and later; perianth cylindrical, to 1½ in. long, the segms. ovate and obtuse; stamens at length just exserted. Coast region, S. Afr. B.M. 6116. J.F. 4:362.—The plant grown under this name is likely not to be the true botanical species here described.

EE. *Color of lvs. bright green.*

5. **Búrchellii**, Kunth. Lvs. ensiform-acuminate, 2–3 ft. long, ½–¾in. wide, sharply keeled, 15–20 ribs each side of midrib, smooth on the margin: spike 6–12 in. long, on a stout peduncle 3 ft. high; fls. bright yellow, much tinged with red when young; perianth somewhat cylindrical, to 1½ in. long, the segms. as long as broad and ovate; stamens at length just exserted. S. Afr. B.R. 1745 (as *Tritoma Burchellii*).—Probably the true *K. Burchellii* is not now in commerce.

6. **longicóllis**, Baker. Lvs. ensiform, sharply keeled, 2 ft. long and 1 in. broad at base, smooth on margins: raceme dense and short, on a slender peduncle 1½ ft. long: fls. lemon-yellow tinged orange-yellow when young, on very short pedicels; perianth somewhat or nearly cylindrical, to 1½ in. long, constricted above the ovary, the lobes small and ovate; stamens and style at length short-exserted. Natal. Gn. 59, p. 96; 63, p. 92. Gn.W. 20:120.

DD. *Stamens prominently exserted.*

7. **sarmentòsa**, Kunth. (*Áletris sarmentòsa*, Andr.). Lvs. ensiform-acuminate, 2–3 ft. long and to 1 in. broad, glaucous-green, sharply keeled, about 12 ribs either side the midrib: raceme cylindrical, dense, 6–12 in. long, on a stout peduncle equaling the lvs.; upper fls. red, the lower yellow or yellow tinged red; perianth cylindrical, to 1 in. long, the segms. broad, ovate and obtuse; stamens and style at length exserted to about ½in. S. Afr. B.M. 744.—It produces underground shoots or offsets.

8. **primúlina**, Baker. Lvs. many, ensiform, 3–4 ft. long and ½–1 in. broad, toward base sharply keeled, smooth on margin: raceme dense, oblong, 3–4 in. long, on a stout and stiff peduncle as long as the lvs.; fls. pale yellow; perianth nearly cylindrical, 1 in. long; segms. small and ovate; stamens and style much exserted. Eastern region. S. Afr. G. 32:299.

CC. *Lvs. linear.*

9. **triangulàris**, Kunth. Lvs. narrow-linear, rather rigid, erect, 1 ft. long, nearly triquetrous, margins smooth: raceme dense, 12–18 in. long, on a slender peduncle 1–1½ ft. long; fls. all yellow; perianth 1 in. long, cylindrical; segms. ovate-oblong and obtuse, longer than broad; stamens and style not exserted. Central region, S. Afr.

10. **Nélsonii**, Mast. Lvs. narrow-linear (the old ones persisting as weak fibers), 1½–2 ft. long, with a thick midrib, rounded and 3-nerved on the back, and recurved serrulate edges: raceme dense, oblong, 2–3 in. long, on a peduncle as long as the lvs.; fls. bright scarlet sometimes tinged orange, all deflexed at expansion, on very short pedicels; perianth cylindrical, 1¼ in. long and narrow; segms. oblong and small; stamens more or less in two series, much shorter than perianth. Kalahari region, S. Afr. G.C. III 11:561; 39:82. Gn. 50, p. 400; 55:166.—It is probable that *K. Nelsonii* is not represented in the garden plants under this name. A hybrid between *K. pauciflora* and *K. Macowanii* has passed under this name, but it is now given the name *K. kewénsis*, N. E. Br.: fls. yellow.

2040. Kniphofia Uvaria.

11. **Macówanii**, Baker (*Trítoma rigidíssima* and *T. maroccàna*, Hort.). Dwarf: lvs. linear, erect and rigid, to 2 ft. long, 3–5 veins either side the midrib, with a thickened scabrous margin: raceme very dense, 2–4 in. long, on a slender peduncle 1–2 ft. long; fls. bright yellowish to orange-red; perianth cylindrical, 1 in. long; segms. ovate and obtuse, reflexed; stamens not exserted. S. Afr. B.M. 6167. R.H. 1879:390. G.C. III. 39:83.—*K. corállina*, Hort., R.B. 19:25 (1893), a hybrid between this species and *K. Uvaria* was raised by Deleuil, of Marseilles: it grows 18–24 in. high and bears ovoid spikes of coral-red fls. all summer and fall: said to be good for cutting. *K. mèdia Macówanii*, Hort.: "a hybrid between *K. aloides grandiflora* and *K. Macowanii*. This is an earlier blooming sort than either of its parents, as dwarf as *K. Macowanii* and much earlier and more brilliant."

12. **natalénsis**, Baker. Lvs. linear, 1½–2 ft. long to ½in. broad, with 10–12 veins either side midrib, margin thickened: raceme not very dense, 6–8 in. long, on a peduncle 2–3 ft. long; fls. mostly yellow; perianth nearly cylindrical, about 1 in. long; segms. ovate; stamens as long as perianth; style at length exserted. S. Afr.—Variable.

13. **longiflòra**, Baker. Much like *K. sarmentosa*, differing in the perianth being twice longer and the stamens scarcely exserted: lvs. linear, 2 ft. long, flaccid, green, sharply keeled, ¾in. wide toward the base: raceme dense, oblong, 3 in. long, on a stout peduncle that is 3 ft. and more tall; fls. yellow-red, strongly deflexed; perianth cylindrical, slender, curved, 1½ in. long; segms. ligulate and obtuse; stamens in two series, included; style long-exserted. Natal probably.

AA. *Perianth short, mostly ¾in. or less long.*

B. *Fls. (perianth) not more than ⅓in. long.*

C. *Color of fls. white, when open.*

14. **modésta,** Baker. Lvs. linear, rigid, 1½ ft. long, sharply keeled: raceme moderately dense and spike-like, secund or 1-sided, 4–7 in. long, on a slender peduncle as long as the lvs.; fls. ½in. long, the perianth cylindrical, and the segms. ovate; anthers at length just exserted. Griqualand, S. Afr.—Probably not in cult., the next having been confused with it. In the original description the fls. are described as yellow.

15. **spársa,** N. E. Br. A much stouter plant than *K. modesta,* with lvs. 2–2½ ft. long: peduncle 2½–3½ ft. high, bearing a spike 9–18 in. long; fls. reddish or reddish; brown in bud but white when expanded, rather laxly scattered and directed to all sides. Natal. B.M. 7293 (as *K. modesta*).

CC. *Color of fls. yellow.*

16. **brevifílora,** Harvey. Lvs. linear, not rigid, 12–18 in. long and very narrow, strong ribs about 5, margin scabrous: raceme dense, 1½ in. or less long, on a slender peduncle as long as the lvs.; fls. yellow, on very short pedicels; perianth cylindrical, ¼in. long; segms. ovate and obtuse; stamens as long as perianth. S. Afr.

BB. *Fls. (perianth) ⅓–¾ in. long.*

C. *Shape of perianth funnelform (flaring at the end).*

D. *Stamens exserted more than the length of perianth.*

17. **comósa,** Hochst. Rootstock thick and short, with copious roots: lvs. many, linear, bright green, to 2 ft. and more long, sharply keeled, edges smooth: raceme very dense, oblong, 3–4 in. long, on a peduncle equaling the lvs.; fls. bright yellow, deflexed, ½in. long and funnel-shaped but dilated suddenly at the middle; segms. very obtuse; filaments red; anthers yellow, long-exserted. Nile Land. B.M. 6569.—This is perhaps more conspicuous by reason of its mass of stamens than the outline of the spike. It is doubtful whether the true *K. comosa* is the same as the cult. plant of that name. Perhaps *K. comosa* and *K. Leichtlinii* of gardens are forms of one species. In the true or botanical *K. comosa* and *K. Leichtlinii,* the spikes are sometimes 2 or 3 on the peduncle; when there is only 1 spike, the uppermost fls. open first, thus reversing the usual order in the kniphofias; when there are lateral spikes, they open from below upward. G.C. III. 56:410.

18. **Leichtlínii,** Baker. Plant with many slender root-fibers: lvs. many, linear, strongly keeled, 3–4 ft. long and ½in. wide toward base, edges smooth: fls. bright yellow; perianth narrowly funnel-shaped, becoming ¾in. long; segms. ovate, very obtuse; stamens and style distinctly exserted (about 1½ times length of perianth): scape speckled with red, sometimes bearing a bract 4–5 in. long, as long as the lvs., the raceme very dense and 3–4 in. long. Nile Land. B.M. 6716. R.H. 1884, p. 556. Var. **aúrea,** Hort. Spike or raceme broad and about 1 ft. long; upper unopened fls. soft orange-red and the lower ones soft yellow.

19. **multifíora,** Wood & Evans. Lvs. 3–6 ft. long, 1 in. broad in middle, long-acuminate, deeply channeled above; strongly keeled, with many strong nerves, margin serrulate, stiffish, bright green above and somewhat glaucous beneath: spike 2 ft. long, dense, cylindric and narrow (1½–2 in. diam.), on a stout peduncle as long as lvs. or shorter; fls. white or suffused with green (buds yellowish), numerous, erect, produced very late; perianth ⅔in. or less long, swollen at base, narrow-funnelform; segms. small and rounded, erect; filaments white, almost twice the length of the perianth. Natal, 5,000–6,000 ft. B.M. 7832. G.C. III. 45:196; 54:356. Gn. 77, p. 587.

DD. *Stamens exserted, not exceeding the length of the tube.*

20. **paucifíora,** Baker. Lvs. few, linear and rigid, 1–1½ ft. long, margin thickened and smooth: raceme lax, 2–3 in. long, on a slender peduncle 1½–2 ft.; fls. pale yellow; perianth narrow-funnelform, ¾in. long; stamens shortly exserted. Eastern region. S. Afr. B.M. 7269. G.C. III. 12:65; 39:101.

21. **púmila,** Kunth (*Tritoma púmila,* Ker-Gawl). Lvs. linear, to 2 ft., glaucous, sharply keeled, 10–12 veins either side of midrib: raceme very dense, 3–4 in. long, on a peduncle equaling the lvs.; fls. red, or yellow to red; perianth narrow-funnelform, to ¾in. long, suddenly dilated above base; segms. ovate and obtuse; stamens and style exserted to ⅓in. S. Afr. B.M. 764.

CC. *Shape of perianth nearly or quite cylindrical: fls. yellow or yellow-red.*

D. *Lvs. very narrow (½in. or less broad).*

22. **grácilis,** Harvey. Lvs. linear ⅛in. broad, 1½–2 ft. long, margin smooth, 5–6 veins either side the midrib: raceme dense, 2–3 in. long, on a peduncle as long as the lvs.; fls. pale yellow; perianth about ½in. long, with a very slender tube and dilated throat; segms. oblong; the longer stamens and the style exserted. Eastern region, S. Afr. R.B. 39:227.

23. **citrína,** Baker. Lvs. many, linear, 1½–2 ft. long and ⅓in. to perhaps ½in. broad toward the base, acutely channelled down the face, slightly scabrous on the edge: raceme oblong, dense, 2–3 in. long, on a slender peduncle shorter than the lvs.; fls. pale yellow; perianth subcylindrical, about ¾in. long; segms. small and ovate; stamens and style much exserted. Coast region, S. Afr.

24. **rúfa,** Leicht. Small: lvs. few, linear, 12–18 in. long and ⅛in. broad toward base, firm and green, sharply keeled on back, tapering to a long point, margin smooth: raceme lax, 4–6 in. long, on a moderately stout peduncle as long as the lvs.; lower fls. primrose-yellow and upper ones tinged red, drooping; perianth cylindrical, ¾in. long; segms. orbicular, spreading; stamens and style at length exserted. Natal. B.M. 7706. G.M. 47:562.—Blooms early and for a long season; a good border plant.

DD. *Lvs. broader (¾–2 in., toward base).*

E. *Stamens short-exserted.*

25. **Túckii,** Baker. Lvs. ensiform, bright green, 1–1½ ft. long, ¾in. wide, margin serrate: raceme very dense, 5–6 in. long, on a peduncle shorter than the lvs.; fls. yellow, tinged bright red when young, deflexed; perianth subcylindrical, ⅝in. long; segms. short, ovate and obtuse; stamens shortly protruding. Central region, S. Afr.—One of the hardiest.

EE. *Stamens much or prominently exserted.*

26. **Týsonii,** Baker. In character, between *I. pumila* and *I. sarmentosa:* lvs. linear, 3–4 ft. long and at base ¾in. broad, tapering to a long point, sharply keeled: raceme very dense, 6 in. long, on a peduncle that equals the lvs.; fls. red-yellow; perianth cylindrical, ¾in. long; segms. nearly orbicular; stamens protruding to ⅓in. or less. Eastern region, S. Afr. Gn. 77, p. 538.

27. **foliósa,** Hochst. (*K. Quartiniàna,* A. Rich.). Lvs. densely tufted, 2–3 ft. long and to 2 in. broad, ensiform, acuminate, sharply keeled: raceme dense, oblong, on a very stout peduncle equaling the lvs.; fls. yellow; perianth cylindrical, about ¾in. long; segms. small, ovate and obtuse; stamens much exserted. Transvaal. B.M. 6742.

K. elménsis, Hort. Garden hybrid (Sprenger, Naples) between K. pauciflora and K. rufa.—*K. erécta,* Hort. Remarkable hybrid: spike conical before anthesis, the buds spreading horizontally, but as the spike develops the fls., beginning with the lowermost, take an erect position, at the same time the axis of the spike elongating, finally all the fls. becoming erect: fls. brilliant orange-scarlet, fading from below upward, never expanding. G.C. III. 56:410.—*K. excélsa,* Hort. Garden hybrid, parentage not recorded: remarkable for enormous size and almost campanulate fls.—*K. Goldélse,* Hort. Seedling from K. Nelsonii and K. pauciflora: fls. pure yellow. G. 32:29.—*K. hýbrida,* Hort., is a trade name used to include varieties with personal names, of miscellaneous or unknown paren-

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tage. The new "everblooming" poker-plants are likely to be listed under this name.—*K. Pfitzerii*, Hort. (K. grandiflora multiflora, Hort.). Described as in bloom from Aug. to Oct., with spikes standing 3–4 ft. high, the fls. rich orange-scarlet.—*K. rubria*, Hort. Garden hybrid between K. rufa and K. Uvaria (Sprenger, Naples).—*K. sulphùrea*, Hort. Free-flowering, sulfur-yellow.—*K. tricolor*, Hort. Small-fld.; buds opening cochineal-red, changing to canary-yellow and then to sulfur-white.—*K. somerénsis*, Hort. Garden hybrid (Sprenger, Naples) between K. pauciflora and K. rufa.—*K. Woòdii*, Campbell. Resembles K. modesta, but is stouter and there are a few spines on the lvs.: peduncle 3½ ft., the raceme 9 in. long; fls. ½in. long, pale cream-color. S. Afr.

WILHELM MILLER.
L. H. B.†

KNOWLTÒNIA (Thos. Knowlton, 1692–1781, curator of the botanic garden at Eltham, England). *Ranunculàceæ*. By some referred to Anemone, but differs in having 5 sepals and numerous petals, and the carpels soft and fleshy: species 8 or so in S. Afr., sometimes mentioned as half-hardy or as greenhouse subjects, but apparently not in the trade. Stemless perennial herbs, with large ternately decompound rigid radical lvs., no involucre, numerous 1-seeded carpels which become thick and juicy at maturity, and greenish or yellowish fls. on branching cymose or umbellate scapes. *K. vesicatòria*, Sims, with lvs. 1 ft. or more across, green fls. and blackish purple berries: lf.-segms. nearly entire or only serrulate: ovaries as long as the subulate style. B.M. 775. B.R. 936. *K. rigida*, Salisb., with lvs. rather smaller, segms. sharply serrate, and ovaries shorter than the subulate style: variable. H.F. II. 7:72.

L. H. B.

KOA. A species of Acacia (*A. koa*, page 186), from the wood of which the Hawaiians make their beautiful highly polished "calabashes."

KÒCHIA (after W. D. J. Koch, 1771–1849, professor of botany at Erlangen; wrote a flora of Germany and Switzerland). *Chenopodiàceæ*. SUMMER CYPRESS. MOCK CYPRESS. This includes two hardy annuals, called the "mock cypress" or "summer cypress,"

2041. Kochia trichophylla; often grows in a more ovoid form.

grown for the compact habit and the herbage which is green in summer and turns red in autumn.

Kochia is a polymorphous genus of herbs which are often woody at the base: lvs. often minute and narrow, alternate, more or less silky, rarely glabrous: fls. small or minute, sessile, solitary or clustered in the axils of the lvs.; calyx enlarging into a flask-shaped body, which incloses the fr.; perianth orbicular; lobes 5, incurved and bearing horizontal wings on the back or on the tube which are membranous or scarious, distinct or confluent; stamens 5; filaments short or long and compressed; stigmas 2, rarely 3.—Species 30–40, of which one is native in the W. U. S. and the others in the Old World and Austral.

The seed may be sown indoors in April, and the plants set out in May, or the seeds may be sown in the open ground about May 1. The plants should stand about 2 to 3 feet apart.

scopària, Schrad. BELVEDERE. Annual, erect, 3–5 ft., much-branched, more or less pyramidal: branches striate, slender, and close to the main st.: lvs. linear-lanceolate, 2–3 in. long, 2–4 lines wide: fls. inconspicuous, green, in elongated clusters; perianth in fr. provided with very short, triangular, pointed appendages. Cent. Eu.—A plant sometimes grown in gardens for its fastigiate or pyramidal form; used sometimes for brooms. Probably not now grown to any extent in American gardens.

trichophýlla, Stapf. Fig. 2041. The common summer cypress of gardens, although frequently grown under the name of *K. scoparia*, but differing in its ovoid, conical or nearly globular rather than narrow and fastigiate form, by its purple-red color in autumn, and other characters: annual, very much branching, 3–5 ft., making a very compact ovoid object, remarkable for the natural regularity in different plants: lvs. very abundant, alternate, straight, long and linear (2–3½ in. long), sharp-pointed, bright green, puberulent and with long white hairs on the margins near the base: infl. in few-fld. glomerules; fls. polygamous, those on the lateral branches most numerous and female, those at the summit of the principal branches perfect: foliage delicate green, becoming deep red-bronze in autumn. China, probably. R.H. 1907, p. 119. J.H. III. 66:495. —Very useful when formal regular effects are desired, and for its pronounced color in autumn, keeping its shape when most other garden vegetation is destroyed by frost. It is of the easiest cult. This species has been recognized and has come into prominence within the past ten or twelve years.

L. H. B.

KOELÈRIA (G. L. Koeler, professor at Mainz, an early writer on grasses). *Gramineæ*. Tufted perennials, with slender sts.: spikelets 2–4-fld. in dense spike-like panicles.—Species about 12, in temperate regions of both hemispheres; of little horticultural value.

cristàta, Pers. Culms 1–1½ ft., puberulent below the panicles: lvs. fine, mostly basal. Dept. Agric., Div. Agrost. 20:136. Prairies, N. Amer.—Sometimes cult. for lawn decoration in open dry ground.

A. S. HITCHCOCK.

KOÈLLIA: *Pycnanthemum*.

KOELLIKÈRIA (Professor Koelliker, German botanist). *Gesneriàceæ*. One species, a small herbaceous warmhouse plant, **K. argyrostígma,** Regel, Cent. Amer. to Peru, offered abroad: in the way of achimenes, but fls. smaller in leafless racemes, the corolla-limb distinctly 2-lipped: rhizomatous or the root creeping: lvs. opposite, soft-pubescent, elliptical and nearly or quite obtuse, velvety green and marked with white dots: fls. white or cream-color, red-spotted, in racemes standing 12 in. high; calyx-tube obovoid, the lobes 5 and narrow; corolla-tube short, broad and decurved; upper lip 2-parted and nearly erect; lower lip larger, 3-parted, spreading; stamens attached in base of corolla, somewhat exserted; style filiform, the stigma becoming 2-lobed: caps. 2-valved. B.M. 4175 (as *Achimenes argyrostigma*).—Requires treatment probably of achimenes; prop. by division.

L. H. B.

KOELREUTÈRIA (Joseph G. Koelreuter, 1733–1806, professor of natural history at Karlsruhe). *Sapindàceæ*. Ornamental trees, grown for their large panicles of yellow flowers and the handsome compound foliage.

Deciduous: winter-buds small, with 2 outer scales: lvs. alternate, petioled, estipulate, pinnate or bipinnate, with serrate lfts.: fls. in large terminal panicles, yellow, symmetrical; calyx deeply divided into 5 unequal lobes; petals 4, turned upward, lanceolate, clawed, the blade cordate at the base with 2 upturned appendages; disk crenate at the upper margins; stamens 8, sometimes less, with long filaments; ovary superior, 3-celled, style 3-fid at the apex, shorter than stamens: fr. a bladdery, loculicid caps., with papery walls; seeds usually 1 in each cell, roundish, black.—Five species in China and Japan.

2042. Koelreuteria paniculata. (×⅓)

The koelreuterias are medium-sized rather sparingly branched round-headed trees with light green pinnately divided leaves and small yellow flowers in large terminal panicles appearing in summer and followed by conspicuous bladder-like pods. *K. paniculata* is hardy as far north as Massachusetts, though occasionally killed back in severe winters; as a rule it is a short-lived tree. The other species are more tender. They are not particular as to the soil and prefer sunny positions. Propagation is by seeds, which are usually freely produced and sown in autumn or stratified, also by root-cuttings.

paniculàta, Laxm. (*Sapíndus chinénsis*, Linn.). Figs. 2042–2044. Tree, to 30 ft.: lvs. pinnate or sometimes bipinnate, to 14 in. long; lfts. 7–15, ovate to oblong-ovate, coarsely and irregularly crenate-serrate, at the base often incisely lobed, glabrous above, pubescent on the veins below or nearly glabrous, 1–3½ in. long: fls. yellow, ½in. long, in broad panicles to 18 in. long; filaments hairy: caps. ovate-oblong, gradually narrowed into the pointed apex, 1½–2 in. long. July, Aug.; fr. in Sept. China, Korea, Japan. I.T. 4:147. G.C. III. 2:561. B.R. 330. Gng. 2:353; 8:219. Gn. 32, p. 378. J.H.S. 27, p. 875. G.W. 5, p. 81; 9, p. 9; 13, p. 529.—It is often cult. in the Cent. W., Kans., Mo., and southward, as an ornamental tree, as it stands drought and hot winds well. It is there popularly known as "pride of India" or "China tree," but the first name belongs properly to *Melia Azedarach* and the second to Sapindus; it is also sometimes called "varnish tree," but the true varnish tree is *Rhus verniciflua.*—*K. japónica*, Sieb., is scarcely different; it is said to differ in its more deeply serrate lvs. and smaller fr.

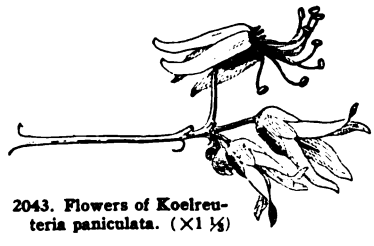
K. apiculàta, Rehd. & Wilson. Closely allied to K. paniculata. Tree, to 35 ft.: lvs. bipinnate, the pinnæ pinnatifid or pinnate at the base, incisely lobed and serrate toward the apex: fr. ovate-oblong, rounded at the apex and apiculate. Cent. China.—*K. bipinnàta*, Franch. Tree, to 60 ft.: lvs. bipinnate with ovate to oblong nearly equally serrate lfts. 1½–4 in. long: fr. globose-ovoid, rounded at the apex. W. China. R.H. 1888, p. 393. Gn. 34, p. 305.—*K. Hénryi*, Dümmer, from Formosa and *K. sinen.* Hemsl., from S. E. China, are not in cult. ALFRED REHDER.

KÖNIGA: *Koniga.*

KOHLÈRIA (named for J. M. Kohler, teacher of natural history, Zurich). *Isoloma*, which see for discussion. *K. bogoténse*, Fritsch=*I. bogotense*, Nichols. *K. picta*, Hanst.=*I. picta*, Planch. (*Gesneria picta*, Hook., not *Achimines picta*, Benth.).

KOHLRABI (*Brassica oleracea* var. *Caulo-Rapa*). Fig. 2045. As the Latin name indicates, this plant is a member of the cabbage group. This group is interesting from a horticultural standpoint because of the great variety in the parts developed to a condition suitable for human food. The kohlrabi is one of the most peculiar of the lot. It is like a turnip produced on a cabbage root, if that were possible. The flesh of the thickened stem resembles that of a turnip, but when well grown it is more delicate, both in texture and flavor. This interesting plant is deserving of a place in every home-garden as well as in the market-garden. In quality it is superior to all other members of the cabbage group save cauliflower. Kohlrabi is naturally a cool-weather plant. To have it at its best it should be grown during the cool days of either spring or autumn and gathered while still young and tender. The soil for kohlrabi should be a rich loam, well drained so as to be available for early planting. Plants may be started in a hotbed and transplanted to the open the same as early cabbage, or the seed may be sown in the open as soon as the season is far enough advanced to sow radish or cabbage seed safely. The rows should be from 15 to 30 inches apart and the young plants planted or thinned to stand 6 to 8 inches apart in the row. The cultivation that would be given early beets will suffice for the plant. The early, quick-maturing sorts should be chosen for table use. The plants should be harvested as soon as the edible portion can be induced to develop to the size of a baseball. If conditions are such as to retard or delay growth, the product is apt to be tough and strong. Quick growth means quality in this plant.

To prepare kohlrabi for market, cut the stem just above the



2043. Flowers of Koelreuteria paniculata. (×1 ⅓)

2044. Pods of Koelreuteria paniculata. *a*, end view. (×⅓)

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surface of the ground and tie three to five plants together by their leaves to form a bunch. To prepare it for the table it should be peeled and cut into dice about ½inch square and cooked the same as cauliflower. Vilmorin says that some of the large, coarse varieties are grown in Europe for stock feed. It is doubtful whether it will ever find favor in this country for this purpose for the reason that in most localities turnips, cabbage, or marrow kale will outyield it.

L. C. CORBETT.

KOLKWÍTZIA (after Richard Kolkwitz, professor of botany, Berlin). *Caprifoliàceæ*. A shrub allied to Abelia, but differing in the fls. being arranged in pairs at unequal height, one above the other, in the sepals not enlarging after flowering and in the numerous ovules. Only 1 species in Cent. China, recently intro.; it has proved hardy at the Arnold Arboretum, but has not yet flowered. Prop. is by greenwood cuttings in late summer. **K. amábilis,** Graebn. Small deciduous shrub with slender, hairy branches: lvs. ovate, acute or acuminate, rounded at the base, denticulate or nearly entire, sparingly hairy above, more densely hairy below, 1–1¾ in. long: fls. in axillary slender-peduncled pairs, forming short panicles at the end of short branchlets; sepals linear; corolla tubular-campanulate, white, flushed with pink, puberulous, ½in. long; stamens 4, included: fr. a usually 1-seeded ribbed achene, crowned by the persistent stipitate calyx, in pairs. H.I. 30:2937. B.M. 8563.

ALFRED REHDER.

KÒNIGA (Charles Konig, of the British Museum early in last century). Sometimes written *Kœniga*. *Cruciferæ*. A genus established in 1826 by Robert Brown, but now included in Alyssum. Trade-lists still contain *Koniga maritima*, R. Br., which is *Alyssum maritimum;* and *K. variegata* of lists is the variegated form of *A. maritimum*. *K. spinosa*, Spach =*Alyssum spinosum*.

KÓPSIA (Jan Kops, Dutch botanist, 1765–1849). *Apocynàceæ*. A few trees or shrubs (upward of a dozen species), somewhat allied to oleander, grown in warmhouses and also offered (species not given) in S. Fla. Lvs. opposite, very short-petioled: fls. white or pink, in terminal cymes; calyx 5-parted, the segms. with glandular tips; corolla salverform with a very slender tube and a hairy throat; stamens inserted near the top of the tube, not protruding; disk of 2 glands: fr. 2 carpels; 1-celled, coriaceous or fleshy. India and Malaysia to the Philippines. *K. fruticòsa*, A. DC. Large evergreen shrub, with lvs. 4–8 in. long, elliptic or elliptic-lanceolate: fls. pink, the tube 1½ in. long and limb 1–2 in. across. *K. ornàta*, Hort., shrub from Malaya, with large oblong-lanceolate glossy lvs., and white red-centered salverform fls. in corymbose panicles; apparently not botanically described under this name.

L. H. B.

KOROLKÒWIA: *Fritillaria. K. Seweræowi*, Regel and *K. discolor*, Hort.=*F. Seweræowi*.

KORTHÁLSIA (Peter W. Korthals, a German botanist). *Palmàceæ*, tribe *Lepidocàryeæ*. Feather-leaved palms from farther India to Borneo and New Guinea, little grown in warmhouses. Climbing and usually spiny plants with pinnatisect lvs., the lfts. mostly more or less cuneate or trapezoid and erose: fls. perfect, crowded in cylindric and catkin-like spikes; sepals orbicular or oblong, and petals ovate or lanceolate; stamens and staminodia 6 or more: fr. 1-seeded, nearly globular or ovoid: spadix axillary and loosely branched, pendulous, in sheathing tubular presistent spathes: some of the ligules of the petiole-sheath harbor ants.—About 20 species, imperfectly understood. One species is offered abroad. **K. robústa,** Blume (*K. Jùnghuhnii*, Miq.), from Java. Petiole 1 ft. long, not armed; lfts. 7–9, rhomboidal, more or less attenuated below into a stalk-like base, sharp-pointed at apex, 8–16 in. long; rachis backwardly or retrorsely hooked or armed; end of lf. terminating in a hook-like process. Java.

L. H. B.

KOSTELÉTZKYA (named for V. F. Kosteletzky, professor of medicinal botany at Prague, and author of several books). *Malvàceæ*. Perennial herbs or shrubs closely related to Hibiscus, 6 species of which are found in Amer., 1 in. Abyssinia and 1 from W. and Cent.

2045. Kohlrabi.

Italy through S. Russia to Persia. Lvs. sagittate, lobed: fls. solitary or clustered in the axils of the lvs., often in terminal panicles or racemes, pink, purple or white; bractlets 7–10, often very small or obsolete; staminal column entire or 5-toothed; ovary 5-celled with 1 ovule in each cell: caps. depressed, dehiscing loculicidally along the 5 projecting angles. **K. pentacárpa,** Ledeb., is the only European species and has been described in horticultural literature abroad. An erect plant, about 3 ft. high: lvs. cordate, toothed: fls. purple-red, rather large, borne singly on peduncles a little shorter than the lvs. **K. virgínica,** Presl. Foliage pubescent, often scabrous: sts. 1–4 ft. high, branching: panicles leafy; calyx caneecent; petals pink or purple: caps. hirsute at maturity. Marshes along the coast, N. Y. to Fla. and La.

KRAMÈRIA (John George Henry Kramer, of Hungary in the early part of the 18th century). *Leguminòsæ;* by some referred to *Polygalàceæ*. Woody plants, or perennial herbs, of minor horticultural value, sometimes grown in the warmhouse, from Trop. Amer., upward of a dozen species. Silky-tomentose: lvs. alternate, small, entire or of 3 lfts.: racemes terminal, carrying red or purplish fls.; sepals 4 or 5, about equal; petals 5, very unequal in sets of 3 and 2, the former long-clawed and connate or rarely free, the 2 orbicular and very much shorter; stamens 4, connate part way, the anthers opening by a pore: fr. 1-seeded, coriaceous and indehiscent. *K. triándra*, Ruiz & Pav., of Peru, is probably the most important species horticulturally: small shrub: lvs. alternate or scattered, close together, elliptic or obovate, apiculate, hairy: fls. bright scarlet. This and other species supply the rhatany root of apothecaries.

L. H. B.

KRAÛSSIA: *Tricalysia*.

KRÍGIA (David Krig or Krieg, an early collector in Maryland and Delaware). Syn. *Adopògon*, Neck. *Compósitæ*. Hardy herbaceous plants, annual and

perennial, yellow-flowered and sometimes called "dwarf dandelions."

Scapose or leafy-stemmed herbs with heads about 1 in. across, usually yellow, and 15–20 pappus bristles. They differ from the common dandelion in having a pappus composed of both chaff and bristles, instead of bristles alone.—Five species natives of the Atlantic and Gulf states westward, of which three perennial species are cult. by dealers in native plants. Unlike the common dandelion these plants do not become weedy. In the southern states there are two annual species, *K. occidentalis*, Nutt. (*Cymbia occidentalis*, Stand.), and *K. virginica*, Willd. (*K. caroliniana*, Nutt.).

A. *St. a leafless scape, bearing 1 head.*

B. *Plant a tuberous perennial.*

Dandèlion, Nutt. Height 6–18 in., glabrous and bluish green: lvs. lanceolate or almost linear, varying from minutely toothed to pinnatifid: head about 1 in. diam., solitary, the rays yellow. April–June. Moist ground, Md. to Fla. and Texas.—The only kind that has tubers.

BB. *Plant has no tubers, but perennial.*

montàna, Nutt. (*K. Dandèlion* var. *montàna*, Chapm.). Height 9–12 in.: lvs. oblong to linear, varying from entire to pinnatifid: head smaller than in *K. Dandelion*. Crevices of rocks, Alleghenies, N. C. and S. C. and Ga.—Harlan P. Kelsey says that this is an admirable rock-plant, thriving in any soil or situation, and blooming profusely from March to June or July. Prop. by seed or division.

AA. *St. 1–3-lvd., branched above, bearing 2–6 heads.*

amplexicaùlis, Nutt. (*Cynthia virginica*, Willd.). Perennial, the st. 1-lvd. and 12–24 in. in height: lvs. oblong or oval, obtuse, entire or repand and denticulate, or the root-lvs. somewhat lyrate; st.-lvs. partly clasping: heads about 2 in. diam., the rays showy, orange-yellow. May–Oct. Moist banks, Ont. to Ga., west to Manitoba.

N. TAYLOR.†

2046. The Nagami kumquat.— Fortunella margarita.

KRYNÍTZKIA (Prof. J. Krynitzki, of Cracow). *Boragināceæ*. Annual and some perennial herbs, with small flowers nearly always white, two of which have been listed for wild-gardens and borders.

Closely allied to Eritrichium, with which the genus has been united; by other writers the genus is broken up in Allocarya, Cryptanthe and Oreocarya. As defined by Gray, the characters are founded mostly on technical features of the nutlet. The species are mostly natives of the W. U. S., and of small promise horticulturally, being usually coarse herbs.

glomeràta, Gray (*Eritrichium glomeràtum*, DC.). Biennial, coarse, grayish prickly-hirsute, 1–3 ft. high: lvs. spatulate or linear-spatulate: fls. white, thyrsoid-glomerate. Plains, along eastern base of Rocky Mts. and to Wash.

barbígera, Gray (*Eritrichium barbigerum*, Gray). Hispid and hirsute, 9–12 in. high: lvs. linear: fls. white, in solitary or panicled, elongating spikes. S. Calif., Ariz., Nev. to Ore.

L. H. B.

KÙHNIA (Dr. Adam Kuhn, an early botanist of Philadelphia). *Compósitæ*. American herbs, closely allied to Eupatorium, seldom planted in the wild garden or border. Perennials, with mostly alternate resinous-dotted lvs., and small whitish or purplish heads in late summer and autumn. From Eupatorium, Kuhnia differs in having 10-angled or -costate achenes rather than 5-costate. Species perhaps 4 or 5, Atlantic U. S. to Texas and Mex. *E. eupatorioìdes*, Linn., is the species most likely to appear in cult. grounds: 2–3 ft., erect: lvs. ovate-lanceolate to oblong-lanceolate or linear, the uppermost usually entire but others usually few-toothed and sometimes short-petioled: heads of white fls. cymose-clustered. Dry places, N. J. to Dak. and S.; very variable.

L. H. B.

KUMQUAT or **KINKAN.** Fig. 2046. A group of dwarf evergreen citrous fruits of the genus Fortunella but formerly referred to Citrus, introduced into England by Robert Fortune, collector for the Royal Horticultural Society, London, from the provinces of Foo-chow-foo, Chusan and Ningpo, China, May 6, 1846. In both China and Japan the kumquat is grown extensively. A. J. Downing reports the variety Nagami (*Fortunella margarita*) as being in America in 1850, having been brought from England, and importations from Japan by Florida nurserymen between 1885 and 1890 included the Marumi (*F. japonica*) variety. Shortly after their introduction into America, both varieties were distributed throughout the Gulf coast and California citrous regions and soon attracted attention for their ornamental value. Later the variety Neiwa (*F. crassifolia*) was introduced but is not yet commonly known. While the kumquat was first regarded as an ornamental in America, it was soon realized that its fruit is valuable for many culinary purposes. In consquence it has been largely planted in many sections, particularly along the Gulf of Mexico.

The kumquats are distinctly shrubby in growth, reaching a height of 10 to 15 feet and an equal distance across the branches. The twigs, branches and leaves make a very dense symmetrical head. The leaves are narrow, elongated, pointed or rounded at the apex, dark green. Thorns are absent or very small. The flowers are small, white and sweet-scented. The first blooms produced in early spring are usually without pistils and of course no fruit results. Later the flowers from which the fruit is produced are borne singly or in clusters of three or four on shoots that

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arise from the first growth in spring. There may be one or two successive crops of bloom and settings of fruit. The ripening of the fruit is therefore usually prolonged over a period of several weeks or even months. The fruit is small, either oval or round, orange in color, and borne freely.

The kumquats are among the most hardy of the citrous fruits. In dormant condition they have withstood temperatures as low as 15° F. in the latitude of north Florida without injury, and they have been fruited in the open ground as far north as Augusta, Georgia.

While the kumquat may be budded on any of the stocks commonly used for other citrous fruits, most of them are grown on *Poncirus* (or *Citrus*) *trifoliata*, rough lemon, and sweet orange stocks. When soil and moisture conditions are suitable, *Poncirus trifoliata* is given the preference. It is a very hardy stock and well adapted to the kumquat. For pot culture, when both soil and moisture are under control, it is the best stock to use. The ordinary shield method of budding is used, and the young plants, being of shrubby growth do not require any special training such as must be given other citrous trees.

In orchard planting, the kumquats are usually placed 10 by 10 feet up to 15 by 15 feet apart. Sometimes they are grown in hedges, the plants being set 6 feet apart in the rows and the rows 15 feet apart. The same tillage and fertilizing are required as for other citrous fruits. Plant-food must be available in liberal amounts to keep the fruits up to size, and fertilizers should be applied in goodly amounts in late winter to produce a strong growth in the first spring shoots.

In the matter of pruning, kumquats are very much benefited by rather severe cutting back of the twigs of the previous season's growth in the winter months. Since the fruit is usually gathered with twigs attached, the necessary pruning is given when the crop is harvested, but if the crop is light, additional pruning will be necessary and should be directed toward thinning out the shoots as well as cutting them back. Liberal pruning well in advance of the starting of growth increases both the size and quantity of fruit.

Varieties.

Up to this time three varieties have been introduced into America, as already noted. A fourth variety, Omi, is listed in Japanese catalogues, and there are doubtless still other forms in China and Japan.

Nagami.—Oblong fruit 1¼ to 1¾ inches long, deep orange in color; juice acid; rind sweet, spicy; seeds two to five; season October and through the winter. Usually begins to ripen two or three weeks later than Marumi.

Neiwa.—Fruit 1¼ to 1¾ inches in diameter, round, orange-yellow; juice subacid; rind sweet; season earlier than Nagami; prolific. A recent introduction.

Marumi.—Round; fruit 1 to 1¼ inches in diameter, round, irregular in size; deep orange in color; juice acid; rind sweet and spicy; seeds one to three; season October and through the winter. The earliest variety to ripen.

Nagami is usually considered the most desirable variety, as it is more robust in growth and produces fruit of uniform size. Marumi is very prone to produce fruit that is small and very irregular in size. Nagami is thornless, while Marumi has very short, sharp, slender thorns. As a pot-plant, Marumi is valuable because of its very compact symmetrical growth.

Uses.

Well-grown kumquat plants make handsome ornamentals,—the combination of dark green foliage and small golden fruit being very pleasing. They may be used for hedges, planted singly or in groups.

Large quantities of fruit are shipped for the holiday trade. In gathering the fruit, it is clipped from the plants with leaves and twigs attached and packed in strawberry baskets. There is also a good demand for large sprays of fruit and leaves for decorative purposes.

When eaten raw, well-ripened kumquats have a very agreeable combination of flavors. The outer rind is spicy, the white inner rind is sweet and granular, while the juice is acid.

2047. The round kumquat.—Fortunella japonica. (×½)

The fruit is coming into very general use for the making of marmalade, jelly, preserved and crystallized fruit. Marmalade made from kumquats is esteemed by many above the product made from other citrous fruits.

H. Harold Hume.

KÚNZEA (Gustav Kunze, 1793–1851, German botanist). *Myrtàceæ*. Australian shrubs, sometimes grown in cool or temperate houses: often heath-like, the small entire lvs. mostly alternate: fls. small with extending stamens, in the upper axils or in terminal heads or in a spike below the end of the branch; calyx with 5 small lobes; petals 5, spreading, small; stamens many, free or in series, the filaments filiform; ovary 2–5-celled, 2 to many ovules in each cell. The species are 15–20, allied to Callistemon, Leptospermum, and formerly included in Metrosideros. The cult. requirements of Callistemon (p. 630) will probably suit them. *K. pomífera*, F. Muell., has been mentioned as a fruit-plant (G.C. III. 5:201; copied in A.G. 1889: 127), Mueller saying that it is one of the few really valuable fruit-plants indigenous at the south coast of Austral. "The fruits are of a peculiar acidulous aromatic taste, and very extensively collected by people settled on the coast for the purpose of jam-making." It is described by Bentham as a rigid prostrate shrub: lvs. ovate, varying from nearly orbicular and almost cordate to narrow and acute-based, mostly less than

⅛in. long: fls. white or yellowish, sessile and not numerous but yet forming dense terminal heads becoming lateral by elongation of the branch; stamens numerous, 3 or 4 times as long as the small petals: berry blue, ⅛in. or less diam., crowned by the calyx-lobes. Victoria and S. Austral. L. H. B.

KÝDIA (Col. Robert Kyd, founder of the Calcutta Botanic Garden, died 1794). *Malvàceæ*. Oriental trees, one of which has been cultivated in southern Florida and southern California.

Plants with stellate pubescence: lvs. entire or lobed, palmi-nerved: fls. polygamous, in panicles, white or pink, ornamental; sepals 5, joined at the base, subtended by 4–6 leafy bracts which enlarge in fr.; petals 5, exceeding the calyx and joined to the stamen-tube; staminal tube divided about the middle into 5 divisions, each bearing 3 anthers, which are imperfect in the pistillate fls.: fr. a 3-valved caps.—Two or three species in India.

calycina, Roxbg. Tree, attaining 25 ft.: lvs. 4–5 in. long, 3 in. wide, rounded, cordate, palmately 7-nerved, more or less lobed, midlobe longest, close-felted beneath: infl. much-branched, many-fld.; fls. white or pink, with oblong-spatulate bracts beneath. Trop. India.—Indicated as a stove evergreen abroad. It is doubtful whether the plant is still cult. to any extent. L. H. B.

KYLLÍNGA (Peder Kylling, Danish botanist, died 1696). *Cyperàceæ*. Annual and perennial herbs, of little value horticulturally although one species is sometimes mentioned in gardening literature. Grass-like or sedge-like plants of perhaps 30 species in many parts of the world, with very small fls. in spikelets which are aggregated into spikes or heads. *K. monocéphala*, Rottb., is nearly glabrous with a creeping rhizome: lvs. drooping or arched, in a graceful tuft: culms. 3-angled: spikes terminal, ovoid or cone-shaped, silky, white, the subtending lvs. 3 and spreading-deflexed. India and other warm regions of the Old World, where it is common. This species is recommended for greenhouse work, where, in 4-in. pots, it makes decorative specimens 1 ft. high, requiring a warm greenhouse temperature. G. 2:298; 25:173. Apparently not offered in this country. L. H. B.

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